PROCEEDINGS OF THE TRI-COMMITTEE BUSINESS ADVISORY PANEL ON URANIUM ENRICHMENT

JOINT MEETING

BEFORE THE

SUBCOMMITTEE ON
ENERGY RESEARCH AND PRODUCTION

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY

AND THE

SUBCOMMITTEE ON
ENERGY CONSERVATION AND POWER

OF THE

COMMITTEE ON
ENERGY AND COMMERCE

AND THE

SUBCOMMITTEE ON
ENERGY AND THE ENVIRONMENT

OF THE

COMMITTEE ON
INTERIOR AND INSULAR AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

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Congreſs of the United States
House of Repreſentatives
Waſhington, D.C. 20515

April 10, 1984

Mr. William S. Lee
Chairman of the Board
Duke Power Company
Post Office Box 33189
Charlotte, North Carolina 28242

Dear Mr. Lee:

You are invited to serve on an advisory panel to the Committee on Energy and Commerce, the Committee on Science and Technology and the Committee on Interior and Insular Affairs of the House of Representatives. These three Committees share jurisdiction over the Department of Energy, and in particular, the Uranium Enrichment Program. You have been recommended by several of your peers as one whose expertise and advice would be invaluable to the Committees.

As you may be aware, the Uranium Enrichment Program is the sole supplier in the United States of concentrated, fissionable uranium for use in commercial nuclear reactors. There are several foreign suppliers of enriched uranium, including the Soviet Union, in competition with the Department of Energy.

An urgent national problem has developed in this $2 billion a year program.

In recent testimony before Congress, DOE has enumerated the problems currently being faced by the Enrichment Enterprise such as the burden of expensive production methods tied to heavy electrical requirements and "cut throat" foreign competition exacerbated by a worldwide oversupply. Contract terminations have led to lowered product requirements resulting in reduced program revenues which affects the ability of the enterprise to finance operations including research, development and demonstration of new cost-effective production technologies. The construction of the Portsmouth Gas Centrifuge Enrichment Plant (GCEP) is also a major issue. Resolution of these and other problems must be found in order to maintain a viable domestic enrichment option.

It is essential that the Department of Energy develop a comprehensive management plan which addresses the immediate problems facing the program as well as formulates the best strategy for the long-term. It should consider key factors such as development and deployment of the advanced technologies, new plant construction, old plant retirement, and marketing. In order to assure the reliability and usefulness of this plan, we need a group of individuals, like yourself, who are familiar with these planning and business management activities to function as an "advisory board of directors."

We are inviting you and other prominent business professionals to review the Department's current program management plan and evaluate its sufficiency to provide a long-term strategy for management of the enrichment program. Among the issues which should be addressed by the plan are:

1. Prudent levels of operation of the existing gaseous diffusion facilities and the schedule on which they should be phased out.

2. The scope and schedule for the Gaseous Centrifuge Enrichment Plant currently under construction.

3. The DOE program for the development of advanced enrichment technologies.

4. What DOE should do about existing power contracts for the gaseous diffusion plants. What DOE should do about negotiating long-term power contracts.

5. The projected market DOE should target for its services in the short and long terms.

6. Actions DOE should take to maintain a viable program pending the implementation of the recommendations.

It is expected that a minimum of two days will be required to familiarize you with the issues listed above. It will be left to the panel to decide the time necessary for formulation of recommendations. The Department and its contractors, as well as the Committees, will ensure that adequate briefing materials and personnel will be available. However, panel members' time is requested on a voluntary basis. The panel will be requested to meet at a mutually convenient time in late Spring, following DOE's preparation of the Strategy Paper this month.

The Committees will provide the necessary assistance to the panel such as meeting rooms and transcription services and have arranged for staffing services to be provided by the Congressional Research Service. Upon completion of the panel's review, hearings will be convened by the Committees to receive the panel's findings and recommendations.

We will contact you within the week for your response to this invitation and to establish a time for the meeting.

Sincerely,

Richard Ottinger

Don Fuqua
Chairman
Committee on Science and
Technology

Richard L. Ottinger
Chairman
Subcommittee on Energy
Conservation and Power

Lloyd

Morris K. Udall
Chairman
Committee on Interior and
Insular Affairs

Marilyn Lloyd
Chairman
Subcommittee on Energy
Production and Research

Congreſs of the United States
House of Repreſentatives
Waſhington, D.C. 20515

September 25, 1984

Mr. William S. Lee
Chairman of the Board
Duke Power Company
Post Office Box 33189
Charlotte, North Carolina 28242

Dear Mr. Lee:

Please accept our sincere thanks on behalf of the Committees on Energy and Commerce, Interior and Insular Affairs and Science and Technology of the House of Representatives for your participation on our Tri-Committee Business Advisory Panel on the Department of Energy's Uranium Enrichment Enterprise. We very much appreciate your contribution of time, energy and expertise to our review and evaluation of the Department of Energy's Uranium Enrichment Program.

The panel was quick to grasp the major problems in the uranium enrichment enterprise. Your written report is helpful since it is on target, and contains several significant recommendations that we believe should be implemented immediately. We have already forwarded it to the Secretary of Energy for consideration and implementation. A copy of our letter to the Secretary is enclosed for your information.

It is our plan to publish your report together with the transcripts of the public meeting at which you received briefings on the enrichment program and related issues. We shall forward a copy of this publication to you as soon as it becomes available.

Thank you again for providing valuable assistance to the management and direction of this nation's Uranium Enrichment program.

Sincerely,

Don Fuqua, Chairman
Committee on Science
and Technology

Mo Udall

Morris K. Udall, Chairman
Committee on Interior
and Insular Affairs

Richard Ottinger

Richard L. Ottinger, Chairman
Subcommittee on Energy
Conservation and Power
Committee on Energy & Commerce

Marilyn Lloyd

Marilyn Lloyd, Chairman
Subcommittee on Energy Research
Research and Production
Committee on Science & Technology

Congreſs of the United States
House of Repreſentatives
Waſhington, D.C. 20515

October 1, 1984

The Honorable Donald P. Hodel
Secretary
Department of Energy
Forrestal Building
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Secretary:

The Business Advisory Panel established by the Committees on Energy and Commerce, Interior and Insular Affairs and Science and Technology, has completed its review of the DOE Uranium Enrichment Program and transmitted its report to us.

We have found the 15 recommendations contained in the report to be extremely valuable and worthy of further consideration. We believe that you will find the report thought-provoking and valuable and are therefore forwarding it to assist you in your efforts to improve the Enrichment program.

The Business Advisory Panel was asked to review the enrichment enterprise from a strictly commercial point of view without regard to the legal and statutory framework of the program. The Panel's recommendations should be read in this light.

The report commends the Department on the progress it has made to date, but the recommendations indicate that the program has a considerable way to go to achieve a "business like" operation.

Although each of the recommendations deserves careful evaluation, the Committees would like to highlight the two which, from our point of view, are the most valuable. We recommend these for your immediate consideration and implementation.

1. The panel suggests that before the program can achieve its goal of operating on a "business-like" basis, it must set for itself "specific written business objectives for the enrichment enterprise, including numerical goals for sales, costs, capital requirements and revenues needs ... and must clearly define a market policy and strategy."

The Honorable Donald P. Hodel
October 1, 1984
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The Committees would find this information most useful if it were provided to Congress no later than the time the Department submits its FY 1986 Budget Request.

2. The panel report strongly encourages the Department to incorporate business planning and market and financial evaluations into the selection process for any advanced technology. The Panel suggests, and we concur, that the selection criteria "should put less emphasis on the technical sophistication and large scale engineering efficiency of advanced technologies and more on the business values of the technical features." The panel also suggests that DOE expand its set of deployment schedules to increase the usefulness of these analyses.

We believe this recommendation is crucial for the success of the technology decision and consequently for the long-term economic viability of the program. This major recommendation appears amenable to immediate implementation. We request that you keep our Committees informed on the Department's progress in implementing this recommendation.

We hope this report will be used by you, and we and our staff stand ready to discuss the report with you or your staff. We look forward to working with you in strengthening this country's Uranium Enrichment Enterprise.

Sincerely,

Don Fuqua

Don Fuqua, Chairman
Committee on Science
and Technology

Richard Ottinger

Richard L. Ottinger, Chairman
Subcommittee on Energy
Conservation and Power
Committee on Energy and Commerce

Mo Udall

Morris K. Udall, Chairman
Committee on Interior and
Insular Affairs

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TRI-COMMITTEE BUSINESS ADVISORY PANEL ON THE DEPARTMENT OF ENERGY'S URANIUM ENRICHMENT ENTERPRISE

REPORT TO THE CONGRESS

September 11, 1984

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TRI-COMMITTEE BUSINESS ADVISORY PANEL ON THE DEPARTMENT OF ENERGY'S URANIUM ENRICHMENT ENTERPRISE--REPORT TO THE CONGRESS

INTRODUCTION

In April 1984, the Committee on Energy and Commerce, the Committee on Science and Technology, and the Committee on Interior and Insular Affairs of the U.S. House of Representatives established a panel of business experts to review the program management plans for the Department of Energy's uranium enrichment enterprise and to evaluate whether they provide a good long-term strategy for the management of the enrichment program. The members of the panel are listed in appendix 1. The panel met in Washington, D.C. on August 16 and 17, 1984, for a series of briefings by Department of Energy representatives and others (see appendix 2) and to discuss their findings. This is the report of that panel.

As a business panel, we have restricted our comments to the business aspects of the enrichment program. There are numerous technical, political, and social issues that need to be considered in managing the uranium enrichment enterprise, including important questions relating to safeguarding against nuclear weapons proliferation. However, we believe that first and foremost the enrichment enterprise is a business, and it must be run as such. This is particularly important in view of the rise of strong international competition in the enrichment services business during the past five years. The foreign competition produces with more modern technology and enjoys lower costs than the U.S. enterprise, and it is competent and aggressive. This situation confronts the U.S. with a major challenge in its enrichment business strategy.

GENERAL FINDINGS

For many years the United States enrichment enterprise operated as a monopoly. The lack of competition allowed the United States to use the supply of enrichment services as a tool of foreign policy and to follow a capacity expansion program which was driven by that policy, as well as by optimistic growth forecasts for nuclear power and a premature commitment to investment in new technology, rather than by market forces.

In the past year, the Department of Energy (DOE) has recognized the realities of the marketplace and given increased attention to the business aspects of the uranium enrichment enterprise. This had become critical since the rise of international competition and secondary market sales seriously eroded DOE's market share and placed severe financial constraints upon the enterprise.

The panel applaudes the transition to a more businesslike approach that has taken place at DOE and strongly endorses its continuation. We find that:

-- The current management at DOE's Office of Uranium Enrichment has made progress in going from a technology driven to a market driven mode of operation. However, there is an urgent need for further improvement, and DOE should accelerate the transition.

The U.S. enrichment enterprise faces some difficult challenges. DOE has lost a large share of its market and it is burdened with inefficient excess production capacity and a shortage of revenues needed to finance technology improvements. DOE's enrichment price is currently the highest in the world.

Nevertheless, the panel believes that:

-- There is sufficient vitality and resiliency in the U.S. uranium enrichment enterprise for it to recover from its current difficulties and return to a competitive position in the world market, if managed properly.

We make the following additional findings regarding the current status of the U.S. uranium enrichment enterprise.

-- The enrichment enterprise, like any business, must generate sufficient revenue to meet costs and investment needs. Competitive pricing policies, and a modernization program to support them, are essential;

-- DOE's introduction of the Utility Services (US) contract was an important step toward improving its marketing position. However, the Department needs to be more aggressive in its marketing of the new contract and needs more flexibility in its marketing activities;

-- DOE's cost accounting for establishing the $135/SWU ceiling price under the new contract is consistent with rational business principles, and the price appears sufficient for recovery of costs over a reasonable period of time; and

-- It will be necessary to reduce the price of enrichment below the $135/SWU level for DOE to compete effectively on the world market. If the proper business and technology decisions are made, significant reductions below $135/SWU should be possible while still fully recovering costs.

RECOMMENDATIONS ON ORGANIZATION AND MANAGEMENT

While the DOE has taken laudable steps toward businesslike operation of the enrichment enterprise during the past year, there are numerous obstacles inherent in being a small part of a large government agency which will continue to hamper efforts to run the enterprise like a business. Chief among the obstacles is the difficulty in following a stable long-term business strategy when subject to quadrennial changes in the Administration which may bring in entirely new management teams. The problem of stability is compounded by annual oversight by at least six committees of the Congress with changing memberships and political philosophies.

Also, the location of the enrichment enterprise below the Assistant Secretary level within a cabinet department with numerous responsibilities makes it difficult to respond rapidly to the demands of the marketplace when that is necessary. In addition, the limitations of the Federal pay scale make it difficult to provide the incentive-reward structure needed to retain the best available managers for the enterprise.

The panel believes that operation of the enrichment enterprise in the manner of a private corporation is highly desirable. However, the prospects for actual privatization are uncertain. It could be many years before arrangements for transfer to the private sector which are acceptable to all parties (Congress, the Administration, private enrichment interests, customers and financial institutions) can be arranged. In the interim, an alternative institutional structure which could further the business objectives of the enrichment enterprise should be found.

We recommend that:

-- Congress and the Secretary of Energy should take steps to establish a private business management structure for the enrichment enterprise. Alternative institutional structures under Government ownership should be examined. The proper structure would further the business objectives of the enterprise and be compatible with an approach to privatization of enrichment services.

The organizational structures of Conrail, Comsat, and the U.S. Postal Service are examples of successful models upon which a restructured enrichment enterprise might be based. Numerous other approaches, including the possibility of an independent Federal enrichment administration may be suitable. The Secretary of Energy should consider hiring a private management consultant to examine the benefits of alternative organizational and management structures.

Whatever the new structure is, the panel believes that it is important to minimize political intervention and provide the organization sufficient freedom to apply businesslike practices. In addition, the panel believes that a permanent board of business executives should be established to advise the enrichment enterprise. While the executives might not have the authority of a board of directors in a private corporation, they would bring vital business experience into the enterprise.

The panel realizes that restructuring of the enrichment enterprise may be a lengthy process. We therefore recommend the following steps be taken as soon as possible to improve the businesslike operation of the enrichment enterprise while it remains within the Department of Energy.

-- DOE should establish specific written business objectives for the enrichment enterprise, including numerical goals for sales, costs, capital requirements, and revenue needs; and

-- DOE should increase the involvement of outside business and financial advisors in the management of the enrichment program.

The enrichment enterprise must optimize its long-range production, inventory accumulation, and capital spending, even if it creates imbalances between costs and revenues in the short-term. The Office of Management and Budget and the Congress should recognize that such long-range optimization is in the best interests of taxpayers as well as electricity consumers. We recommend that:

-- To permit implementation of optimized long range business plans, the Office of Management and Budget and the Congress should relieve DOE from the constraint of zero net annual appropriation for enrichment.

RECOMMENDATIONS ON THE TECHNOLOGY SELECTION AND ACQUISITION PROCESS

The most important decisions facing the management of the U.S. uranium enrichment enterprise involve the selection of a technology, the acquisition of new, more cost-efficient enrichment capacity and the closing of obsolete capacity. Both the atomic vapor laser isotope separation (AVLIS) process and the Advanced Gas Centrifuge (AGC) process have the potential to allow significant cost reductions in enrichment. The United States appears to be the world leader in the development of those technologies. However, DOE's competitors are also developing advanced enrichment technologies. Unless the United States chooses the most cost effective enrichment technology and deployment scheme we may not be able to improve our competitive position in the market over the long term.

The panel believes that decisions regarding technology selection and new capacity acquisition must be made together. The technology which projects the lowest stand-alone production costs may not necessarily allow the most favorable cost and revenue stream when all factors are considered. It is important that the most cost effective deployment schemes involving the two advanced technologies, as well as possible mixed deployment schemes, be developed and compared. The scenarios considered should also optimize the use of existing inventories and production capacity.

We also believe that the technology selection and acquisition process must put primary emphasis on the business features of the production technologies. In the past, the U.S. program has placed too much emphasis on sophisticated technology and large-scale deployment schemes. The panel believes that business oriented features such as flexibility of deployment, ability to add small increments of capacity, maintainability, adaptability to a variety of operating conditions and market demands, facility lifetime, and possibilities for upgrading are all important factors in technology selection, which have not been considered sufficiently in the past.

These are all matters that should be considered by the Process Evaluation Board (PEB). The panel cannot overemphasize the importance of the activities of the PEB to the future business success of the enrichment enterprise. We note that the selection criteria for the PEB were apparently established without outside business and financial assistance and that all seven members of the PEB are Department of Energy employees. It is essential that the recommendations of the PEB be made from a business point of view including market and financial as well as technical issues. We therefore recommend that:

- DOE should provide for review and appraisal of all PEB activities by independent business and financial advisors;
- The PEB should be assisted in selecting the specific criteria and objectives for choosing among optimized deployment scenarios for the advanced enrichment technologies, including the possibility of mixed deployment scenarios; and
- The technology selection criteria should put less emphasis on the technical sophistication and large scale engineering efficiency of advanced technologies and more on the business values of the technical features, particularly the ability to add or modify small increments of capacity and provide flexibility in responding to the market.

In addition to making the correct decision regarding technology selection and deployment of new enrichment capacity, it is important that the decision be made in a timely manner, that the best possible information for making the decision be generated in the time available and that no unnecessary expenditures on new capacity be made while the decision is pending. The panel therefore urges that all current efforts of the enrichment research and development program be directed toward the May 1985 decision date for technology selection and deployment and recommends that:

-- DOE should make every effort to select an advanced technology and associated deployment scheme by the May 1985 decision date. Delay past that date should occur only in extreme circumstances; and

-- Research and development activities between now and May 1985 should be directed toward obtaining data and information needed for a business decision at that time.

The panel is concerned that there may be an imbalance in the current U.S. enrichment program favoring on-going operations and new construction at the expense of the potentially more profitable new technology developments. With the market eroded and the U.S. capacity well in excess of near- and mid-term needs, we are not convinced of the business value of continued deployment and construction at GCEP using soon to be superceded technology. Accordingly, we recommend that:

-- In the absence of sound business rational, GCEP construction and acquisition of Set III centrifuge machines should not continue beyond minimum commitments.

RECOMMENDATIONS ON MARKETING

An effective marketing capability is a key step in managing a successful business. DOE has made great strides in marketing its enrichment services in the past year, but DOE's marketing performance still lags behind that of its European competitors.

DOE's European competitors, which are organized as private corporations, have the freedom to tailor their prices and contract terms on a case-by-case basis. On the other hand, DOE is constrained to being non-discriminatory. The extra flexibility they have in pricing and contracting undoubtedly helps the foreign enrichers. However, the panel believes that the superior marketing performance of DOE's competitors stems as least in part from their having clearer market objectives and greater organizational emphasis on marketing than does DOE. We believe that it is critically important for the U.S. enterprise to continue to strengthen its marketing and sales capabilities. To achieve that, we make the following recommendations:

-- A strengthened marketing and sales organization must be formed, which is responsive to policy, but executes on sound business principles. DOE should consider help from a professional marketing agent to provide aggressive marketing services;

-- DOE must clearly define a market policy and strategy. Near-term priority should be on sales in the U.S. market. Overseas sales should be pursued only insofar as they provide an advantage to U.S. taxpayers or electricity consumers as part of a sound and profitable business strategy; and

-- If overseas sales are determined to be advantageous to the United States in the long-term, they should be pursued aggressively, but with realistic goals. At this time it appears that the most promising opportunities for overseas sales are in the Far East.

RECOMMENDATIONS ON COST REDUCTION MEASURES

The panel is impressed by the diffusion plant operating contractors' continuing performance in reducing the cost of operations. DOE has also recently begun to seek out low-cost electrical power for the diffusion plants in an aggressive manner. We applaud that effort and encourage DOE to continue it. However, we believe that DOE has not taken sufficient action on two cost cutting measures of potentially significant magnitude--closing a diffusion plant and reducing the impact of power demand charges.

The U.S. diffusion plants are being run at about one-third of their capacity. In addition, the enterprise has a current inventory greater than its annual sales. Nevertheless, DOE projects that if one of the diffusion plants is closed, enrichment demand may exceed production capacity beyond 1991. The panel is unconvinced that the temporary shortfall in such situations, if it developed, could not be accommodated by preproduction of enriched material or by other means. Keeping three diffusion plants operating at low efficiency does not appear to be the most cost effective means of dealing with potential short-term capacity shortfalls. We recommend that:

-- DOE should critically examine diffusion plant operations and select the minimum-cost plan to supply the demand. If this examination confirms our expectations, DOE should shut down the least cost-efficient diffusion plant as rapidly as practicable.

The problem of reducing the impact of demand charges is more difficult. The panel recognizes the Tennessee Valley Authority's (TVA's) right to insist that contracted capacity demand charges be paid. However, we do not understand why TVA has thus far barred DOE attempts to resell the power it is committed to purchase. We believe that it should be possible to make an arrangement for the resale of power in which all parties (DOE, TVA, and purchasing utilities) benefit. We believe that TVA should allow the resale of contracted power by DOE and provide for wheeling of it as necessary, we therefore recommend that:

-- DOE and the Congress should encourage TVA to allow the resale and wheeling of DOE's extra contracted power under terms in which all parties benefit.

In addition to reducing costs, DOE should ensure that customers equitably share the costs of uranium enrichment. To this end, DOE should separate the extra costs associated with the production of highly enriched product for government purposes from the cost associated with low enriched product for civilian needs and reflect such separation in its pricing formula.

In conclusion, we wish to reaffirm our confidence in the underlying strength of the U.S. uranium enrichment enterprise. We believe that if the proper business practices are followed, the United States could regain a strong competitive position in the world enrichment market.

APPENDIX 1

MEMBERS OF THE TRI-COMMITTEE BUSINESS ADVISORY PANEL ON THE DEPARTMENT OF ENERGY'S URANIUM ENRICHMENT ENTERPRISE

Mr. Norman R. Barker
Vice President
Gilbert Commonwealth

Dr. Roger Bohn
Professor
Harvard Business School

Mr. William S. Lee, Chairman
Chairman of the Board
Duke Power Company

Mr. Lawrence M. Mead
Senior Management Consultant
Grumman Aircraft Corporation

Mr. Frederick S. Potter
Vice President
Merill Lynch Capital Markets

Dr. Clive G. Whittenbury
Executive Vice President
The Erickson Group

Special Assistant to the Panel

Dr. Robert L. Civiak
Specialist in Energy Technology
Congressional Research Service

APPENDIX 2

WITNESSES APPEARING BEFORE THE PANEL ON AUGUST 16 AND 17, 1984

Department of Energy

Hon. Shelby T. Brewer
Mr. John R. Longenecker
Ms. Sherry E. Peske
Mr. Donald K. Geston
Mr. Ewin B. Kiser, Jr.
Mr. Kermit O. Laughon
Mr. William H. Clagett
Mr. Joseph Parks

Martin Marietta Corporation

Mr. Clyde C. Hopkins
Mr. Kenneth Sommerfeld
Dr. Robert Merriman

Lawrence Livermore National Laboratory

Dr. James I. Davis

Garrett Corporation

Mr. Charles J. Rowan

Boeing Engineering Company

Mr. Richard L. Grant

Goodyear Aerospace Corporation

Mr. N. E. Whitchurch

Goodyear Atomic Corporation

Mr. Nathan Hurt

Stone & Webster Engineering Corporation

Mr. Melvin Greer

Nuexco

Mr. J. Robert Wolcott

SWUCO

Mr. Walter Wolff

Cogema, Inc.

Ms. Katrina Farrell-Gisse
Mr. Michael A. McMurphy

Urenco

Dr. Johannes Asyee
Mr. Myron Kratzer

U.S. General Accounting Office

Mr. Kevin Boland
Mr. Tom Melloy

Additional written comments received from:

Atomic Reclamation and Conversion Project
c/o Oil, Chemical, and Atomic Workers Union
Piketon, Ohio

PROCEEDINGS OF THE TRI-COMMITTEE BUSINESS ADVISORY PANEL ON URANIUM ENRICHMENT

THURSDAY, AUGUST 16, 1984

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, COMMITTEE ON ENERGY AND COMMERCE, AND THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,

Washington, DC.

The panel met, pursuant to call, at 9 a.m., in room 2218, Rayburn House Office Building, Hon. Richard L. Ottinger presiding.

Mr. OTTINGER. Good morning. I am Dick Ottinger, Congressman from New York, chairman of the Energy Conservation and Power Subcommittee of the Energy and Commerce Committee.

I want to tell you how very grateful we are to you for giving up your time, donating it, to help us resolve a difficulty, a knotty and kind of fascinating problem.

The three committees that issued this invitation—my committee, the Energy and Commerce Committee; the Science and Technology Committee, on which I also serve; and the Interior Committee—we have a joint objective in seeing to it that the decisions that are made with respect to uranium enrichment, both the long- and short-term, are made on a sound business basis. Since you folks have been telling us for years we are not very good business people, we thought we would invite you in and seek your help.

It is a very knotty decision, and a very fascinating one, one in which I have been involved for some time, but it is the kind of a decision that you and your businesses make from day to day. I think, therefore, you can make a tremendous contribution to us in giving us your judgment on what the Government should do.

At the present time, we face a world surplus of uranium—uranium enrichment. It is produced in Europe, it is produced in Russia, as well as in the United States. A great deal is being produced and the market is very depressed. That is something at least some of your companies are familiar with.

We have a tremendous capacity for producing SWU's in this country with gaseous diffusion equipment which is an antiquated—uses huge amounts of power—and one of the decisions we are going to ask you to help us with is how those machines ought to be phased out.

There are two competing technologies for enrichment in the future, if you pass the first hurdle, and that is decided—and I think it is a very important decision—should the United States continue to be in this business, considering the surplus, should the Government be in it, or should we turn this over to the private sector, or some combination of the two?

Then you get the question—the United States at the present time produces most of the U.S. requirement and still produces some foreign requirements—you get to the question of what do you do with these two new technologies? Both are quite expensive. We have a huge investment at the present time in gas centrifuge technology, and we are proceeding to put in machines which are not the advanced machines which produce the most expensive SWU's in the world. Should we keep doing that? We are doing that in order to keep the manufacturers involved in the processes.

The new technologies, the advance centrifuge and the laser isotope, both are proceeding down the research and development trail, and there is a question of whether the decision of the Government ought to be made this year, which is what the Department of Energy proposed, without the ability to actually test those technologies, or whether those technologies ought to be tested at tremendous additional cost before that decision is made.

As I say, these are the kinds of decisions that I think are made by industry continuously. The law presently reads that the program has to recover its cost.

There is another question, because the existing contract, in order to capture or retain additional business, the existing contracts that were instituted on a new basis a few months ago by the Department of Energy, we and the GAO believe don't recover costs. I don't have any problem with producing below cost if it makes long-term sense. So that is another decision, but we would have to change the law in order to do that. Well, that is basically the scope.

You are going to hear from some of the most knowledgeable and best experts, both in the Government and the private sector that have been working with the Government on this program. You are going to have two absolutely packed days with so many facts and figures, that I am sure your eyes will glaze over before the end of the time. And then Tom, you will meet in executive session and see if you can come up with some kind of consensus.

I would urge you to ask tough questions. We have found that the Department of Energy has not always been completely forthcoming with us. They probably would dispute that, but at any rate, there have been a lot of disputes with respect to the facts and figures. You should not hesitate to challenge information that is given you, and make sure that you are satisfied with the information you are given.

Then what will happen is that we will get a report. Then the committees will have a hearing for you to present that report in September. Since these decisions are pending, and the Department does have a plan to go forward, there is real urgency with respect to this. If we make a mistake at this point, it could be a very costly mistake. If you come out and say the Department of Energy is just doing fine and we endorse everything they are going to do, that will make me happy, too, because it will I think give us a good deal more confidence that what is done is being done on a sound basis.

I am not going to be able to participate with you, and the other Members of Congress have dispersed to the four winds. This basically is not our decision. It is a decision we are asking you to help us with. I think our participation ought to come after you have had a chance to examine the issue and give us the best of your wisdom. I wish you well. It is one of the most fascinating problems I have had to deal with.

Being a Member of Congress is just the most intriguing thing that a person can possibly do, and I am going to miss a good deal of it, but you do get an education everyday. For somebody with no technical background whatsoever, to have the opportunity to learn all about so many topics—uranium enrichment for one—learn the newest scientific technology, is a very exciting thing, and I think you will find it exciting as well as very complex and perplexing in many ways. I wish you well.

Again, I want to thank you very, very much for your agreeing to spend this time looking at this problem.

Mr. KETCHAM. I am Robert Ketcham. On behalf of Don Fuqua, chairman of the Science and Technology Committee, I want to thank you all for being here and taking this time. This problem of uranium enrichment, as Dick has pointed out, is of great concern to us as a program, and the priority and the issues involving nuclear R&D which we got into beginning in 1977 when I think the nuclear jurisdiction was split up, has been something we have been working on over the years, and trying to come to grips with.

It has been focused on so much more in the recent past, because the technology has evolved to a certain point. In trying to analyze what we are doing here today, I tried to come up with some similarities. I don't know whether this is more like a Harvard Business School case study, or whether it is like a patient in a teaching hospital, or perhaps it is just a simple, straightforward problem with oligarchy and monopsony, and all those words that you have heard about, because of the Government's relationship and the national security issues, and the proliferation issues associated with it.

All those things I think you will be fascinated to learn about, and I hope that there is sufficient time for you to come to grips with this. I really don't think it is as complicated as people may think it is. The reporter has already asked what that weird word is that the chairman was using—SWU—so we are already running into something that some people may not have understood.

The chairman would like to be here, but as I mentioned, he has another priority, which is a primary he faces on September 4. So I just wanted to thank you for being here, apologize for his not being here, and wish you the best.

Mr. DUGAN. I want to make some remarks for Mrs. Lloyd. She appreciates Mr. Ottinger's great interest in the subject, as in other nuclear issues over the years. She also appreciates you people giving your valuable time to provide advice to the committee. She thinks it is a very difficult task, given the time constraints, for any group of people to come up with solid recommendations, given the complexity of the issue.

One thing I think she would like to point out is the fact that uranium enrichment business is not a business in the normal sense. And given the constraints that the Congress and others have put on it, in terms of cost recovery and whatever, she would remind you to think about that carefully, that it is treated as a business in one sense, and yet cannot function as a business in another.

My chairman has a particular R&D perspective on this, and is very concerned about the technology choice between advanced laser isotope and advanced gas centrifuge. In that sense—and it is not a political statement—she was distressed to see the Secretary of Energy box in, she felt, the enterprise in terms of committing to no net appropriations for the foreseeable future, which of course ties the enterprise and the R&D funding to the fate of the new contract which the Department of Energy has come out with. She is very distressed about that. That certainly narrows the options, that kind of commitment from the Secretary. She suspects it has come as a result of great pressure from OMB.

She would have preferred I believe, to have a fiscal year 1986 date, which is not too different from some other members of the committee, rather than 1985. The 1985 thing, of course is driven by the fact that the appropriations are going to be relatively low for the advanced technology in Portsmouth, and the overall enterprise.

She is quite concerned, and the committee was—as evidenced in the report—that whichever one wins, the backup technology not be stifled and put away on the backburner, but continued at some healthy level, because of just the fact you have to keep options open. For instance, if the advanced gas centrifuge will win, the AVLIS technology is so promising in terms of economics that you cannot turn your back on it.

Finally, she would say the stakes involved in this enterprise for the U.S. are monumental. She would hope you would recognize that our whole position as a reliable supplier and strong supplier in nuclear enterprise is tied to what we do in enrichment and the R&D areas, and feels you have a great responsibility to give the committee advice on this public policy issue which touches everything from really arms control to the domestic-international traffic in nuclear commerce.

Thank you.

Mr. OTTINGER. I would like to acknowledge the inspiration for doing this—the person who has educated me on the subject and will be available to you as a valuable resource, Jeanine Hull. She is an encyclopedia on these matters. Don't hesitate to call on her for help.

I will turn the proceedings over to you.

Mr. LEE. Thank you for calling us together. We appreciate the opportunity. We appreciate being here.

We also want to thank Mr. Ottinger for the precedent—of establishing as a permissible uniform of the day—shirt sleeves. So be comfortable this August day.

The committee welcomes Assistant Secretary of Energy, Shelby Brewer, and his associate, John Longenecker. We will turn it over to you, Mr. Secretary.

STATEMENT OF SHELBY T. BREWER, ASSISTANT SECRETARY OF NUCLEAR ENERGY, ACCOMPANIED BY JOHN R. LONGENECKER, DEPUTY ASSISTANT SECRETARY FOR URANIUM ENRICHMENT, DEPARTMENT OF ENERGY

Mr. **Brewer**. Thank you, Mr. Chairman.

We, too, are very grateful to Mr. Ottinger for assembling such a panel of distinguished business leaders. It is a business problem that we are facing, and it has been largely due to the inattention to business factors over the past 10 years, 12 years, that led us to the market crisis that we faced in the 1982–83 timeframe.

Our presentation today and tomorrow will not be an exposition of technology, technical chauvinism. It will instead deal largely with the uranium enterprise as a business, in a business context. How did it sour, how did the marketing sour, what steps we have taken to correct it, and is that strategy proceeding on course, is it apt to succeed?

Mr. Chairman, I would like to review very briefly some history of the U.S. enterprise. You will recall that between 1973 and the present we have gone from a monopoly position to a one-third supply situation for the world. There are basically two factors which contribute to this. First of all, the books were closed in 1973.

Mr. **Lee**. Mr. Secretary, excuse me a moment. Would it be just as easy for you to move the easel? Then I think we could see better what you are pointing to as you discuss this.

Mr. **Brewer**. As I said, Mr. Chairman, we were a monopoly in 1974. We are no longer a monopoly. Two underlying factors.

The books were closed in 1973 because the GDP capacity, the forward capacity, was saturated with contract volume. The law said you cannot contract for supply for which you do not have capacity.

Also, in 1977 through 1980 the United States took on an image as an unreliable supplier, further eroding our market position abroad. During the 1970's, as you know, EURODIF and URENCO got into the business and have been very aggressive.

More recently, in 1982, we began to see some erosion in our domestic market, that is to say, our U.S. utilities who are our customers. Until 1982 we were a monopoly there, and then in 1982 and 1983 we began to see some erosion in our domestic market.

There are basically four underlying causes for this phenomenon. First of all, there was a major shift in the exchange rate. In 1981 there were 4 francs to the dollar. There are now eight. Likewise with the deutschmark.

A second factor was the secondary market which had sprung up in Europe and here. This arose because all of the producers were producing into a glut.

They were producing and supplying through fixed commitment contracts, oversupplying the market, and naturally the secondary market developed, and the only target for that market were U.S. requirements contract holders.

A third factor was cost growth. We were paying enormously—enormous power costs to run the gaseous diffusion plants. That was escalating at about 18 percent.

Also, there was a great deal of research and development being heaped into the rate base.

A fourth factor is attitudinal, and it derives as well from the law under which we operate. We do not have the flexibility in the U.S. enrichment enterprise to do predatory pricing, to treat customers differently, to tailor-make enrichment contracts.

All of those things are not open to our—in our tool box. Whereas our competition, EURODIF and URENCO, are not bound by full cost recovery and reasonable time. They are not bound by the uniformity doctrine.

I would like to review for a moment the reasons why the secondary market developed.

In this box, Mr. Chairman, you see the world producers of enriched uranium—the Department of Energy, EURODIF and URENCO. On this side of the chart you see the customers.

We have two basic types of contracts—fixed commitment contracts, which are more or less take or pay. They are very rigid from the customer's point of view.

If you don't take the product, you pay. You pay anyway. We have another type of contract which is very flexible from the customer's point of view—the requirements-type contracts.

What was happening is that the world producers—I might also say that the other producers, EURODIF and URENCO, have more or less take or pay contracts with their equity holders, their consortia members.

What was happening was that we and the Europeans were producing into a glut, we were force-feeding the market. A secondary market, an overage in excess inventories developed, and that excess began to be supplied to our requirements customers.

So, this revenue stream here through the Department of Energy began to be interrupted.

We took steps in the past 18—we have taken steps in the past 18 months to rationalize, normalize the market, and to slim down, shape up, and operate the U.S. enrichment enterprise as a business.

We developed and offered a new contract in January which had three basic fundamental features.

First of all, it is a requirements-type contract. It is not a fixed-commitment contract.

We will not oversupply our customers and continue to feed the secondary market.

A second major feature is that we allow 30 percent of the customers requirements to be met by sources other than the Department of Energy. These sources could include, for example, the secondary market, and will assist in drying up the secondary market, so that we can once again return to a normal supply-demand situation.

The third major feature is the price ceiling—at $135 per SWU, escalated only by national indicators. We will live within our means.

This will permit our customers to predict the price as well as we can. If you read the Wall Street Journal and understand GNP deflators, your assessment of the price will be as good as ours in the future.

Our basic strategy is to normalize the market through the contract conversion process which closes in October. After that is done, after we know what our market volume is into the future, we will then develop and refine a production plan.

By production plan, I mean how we load the GDP's, how we plan for advanced technology, and on what schedule.

However, we have in the past 9 months, 10 months, taken steps on the supply side to reduce costs.

We have deferred GCEP buildings three through eight until we see a market, until we assess the market through the contract conversion process.

We have decided to skip the step between set III vintage gas centrifuge machines and the advanced gas centrifuge machine, that of the AGC.

If gas centifuge is the choice, we will go straight to advanced gas centrifuge. We have also stretched out the set III procurement. Set III machines are being fabricated for installation in the first two buildings.

We have substantially stretched out the procurement of those machines.

And finally, we have accelerated by several years the decision on the technology of the future—the choice between laser technology and gas centrifuge technology.

The old plan had a decision point in 1988-87. By accelerating that decision, by fishing or cutting bait, we will offload a great deal of research and development costs which the ratepayer would otherwise have to pay.

The risk is somewhat higher, but the price will be kept down for that reason.

Mr. Potter. What is the new date?

Mr. Brewer. April 1985. We offered the contract in January of this year. So far we have 77 percent of our customers, have converted. The contracts have been negotiated and are in the typewriter.

There are some 13 percent, or thereabouts, which are yet to be negotiated.

[The prepared statement of Mr. Brewer follows:]

STATEMENT OF
SHELBY T. BREWER
ASSISTANT SECRETARY FOR NUCLEAR ENERGY
BRIEFING FOR THE TRICOMMITTEE ADVISORY PANEL
ON URANIUM ENRICHMENT
U.S. HOUSE OF REPRESENTATIVES
AUGUST 16, 1984

I am pleased to be here today to discuss the Department of Energy's Uranium Enrichment Program, and the actions underway to restore our Nation's enrichment enterprise to a position of world leadership.

During the past 10 years, the United States situation in the enrichment market has evolved rapidly from a monopoly to fierce competition. However, our program and business policies have not kept pace. Our recent analysis of the world market, our competitors, and excess inventories have led us to conclude that business as usual will lead to a catastrophe. U.S. sales and revenues will drop sharply while costs soar. This will force prices still higher, leading to further sales losses. The overall situation is complex, but it is clear that we must compete effectively if we are to solve the problem. Prices must be made reasonable and controlled. Our customers must be treated appropriately. They can and do demand flexibility and strongly support the need for DOE to be a viable and economical enrichment supplier. However, implementing a solution will require close attention to both programmatic and political issues. Implementation of a solution will require strong support from our customers and Congress.

Our new strategy recognizes that DOE is no longer a monopoly in the free world, and must conduct its business in a way that is responsive to customer need, and based on realistic requirements for fuel. The new strategy thus relies on forces of the marketplace to drive program decisions, including the choice on new enrichment capacity, investments for R&D, and production decisions. If we are successful in securing the support of our customers, and we make prudent business decisions regarding future investment, we will achieve our objective of returning to the position of being the world's lowest price supplier of enrichment services.

We plan to compete for business throughout the world primarily because of the important benefits that accrue to this country by having a strong uranium enrichment enterprise. These benefits include having a secure, economic, indigenous fuel source for our nuclear utilities and for defense purposes, creation of jobs, positive balance of trade benefits, and last, but certainly not least, effective nonproliferation control.

We are in the midst of implementing this new strategy, and we'll describe over the next 2 days the actions that have been taken and the areas where options for future actions exist.

As with all complex business problems, we broke it into pieces and began solving it bit by bit. Our near-term strategy was to start by normalizing supply and demand in the marketplace. We issued the Utility Services contract to our customers to achieve this end on January 18, 1984. The demand resulting from conversion of customers to the Utility Services contract will define the basis on which we make production decisions for the future. These include decisions on the use of existing production or possibly the introduction of new technologies which will allow DOE to remain a competitive and reliable supplier of enriched uranium. Response to the

Utility Services contract has been very encouraging to date with over 85 percent of our customers having signed the contract, submitted letters of intent, or giving verbal indication that they will convert. Overall, I believe that our near-term strategy is beginning to work. We are securing market for DOE services and building credibility with our customers.

A key objective is to conduct affairs in uranium enrichment in a businesslike way that will put us in a posture of being able to attract private sector interest and potentially private sector venture capital. Privatization of uranium enrichment remains a fundamental objective of this Administration. Although full privatization at this time may not be feasible, we believe that private sector financial participation in the next increment of enrichment capacity could be the first step toward eventual privatization. We are now evaluating what the next step is in attracting private capital and will be reporting any progress to Congress early in 1985. We are committed to working with the customers, to listening to them and knowing the market well, and to retain our leadership role in new technology development to assure that the United States remains a strong, reliable, low cost supplier. We will return, as soon as possible, to the position of being the world's lowest priced supplier.

Thank you for this opportunity to be with you today, and I hope that you will find the next 2 days to be productive. I look forward to hearing your views of our approach to this crucial business problem. Thank you.

Mr. **Brewer**. John Longenecker would like now to go into more detail on the strategy for the next several years.

Mr. **Lee**. Very good. Mr. Longenecker.

Mr. **Longenecker**. Mr. Chairman, good morning. Thank you.

What I would like to do, before beginning a discussion on strategy and objectives, is how we are going to transfer the information to the group. I am going to describe to you the strategy and objectives, and how we got to them, because I think the considerations in the process of determining the strategy would be of interest to you.

We are then going to get into a basic primer on uranium enrichment, to tell you what kind of business we are in, a little more about the product we produce, and the customer services we provide.

We will then provide a detailed review of our overall market, of our markets, both historically and the new contract, and then describe as the last piece of this morning's agenda, some of the customer services that we provide at Oak Ridge.

This afternoon we will describe for you how we put together our 15-year operating plan, and we will also discuss one of the major elements of our overall budget, and that is electric power, and we will describe the history there, and some of the power negotiations that we are currently involved in.

At the end of the day, we will have a brief discussion of the basic strategic decisions that we see needing to be made in the future. Tomorrow we will devote the morning primarily to a review of the technologies, both the existing technologies and the two advanced technologies.

We will then review for you the progress to date of the Process Evaluation Board in evaluating the selection between the two, and finally, we will talk about our views on private sector participation in uranium enrichment.

Before proceeding, I would like to get any comments on the agenda. Does that appear to be a reasonable way to approach it?

Mr. **Lee**. How much of a primer do you guys want?

Mr. **Potter**. How much are we going to get?

Mr. **Longenecker**. About 20 minutes is what we planned to spend on that.

Mr. **Lee**. Cut it in half, John. And with that adjustment, proceed.

Mr. **Longenecker**. All right. And at any time, if you would like to hear more or less, we will certainly remain flexible.

Mr. **Mead**. Are you going to cover the overall demand situation?

Mr. **Longenecker**. Yes, we will do that this morning.

I would like to focus initially, then, on the major elements of the strategy, a little bit of detail on how we plan to implement the strategy. Shelby has described the complex and rather interrelated problems that were frustrating our attempts to continue to be a reliable low-priced supplier of enrichment services, both to our domestic and foreign customers.

He described how over the last 10 years our market share in foreign countries has dropped. And primarily the one single effect that has impacted our overall strategy is foreign exchange rates.

Figure 1

Foreign Exchange Rates

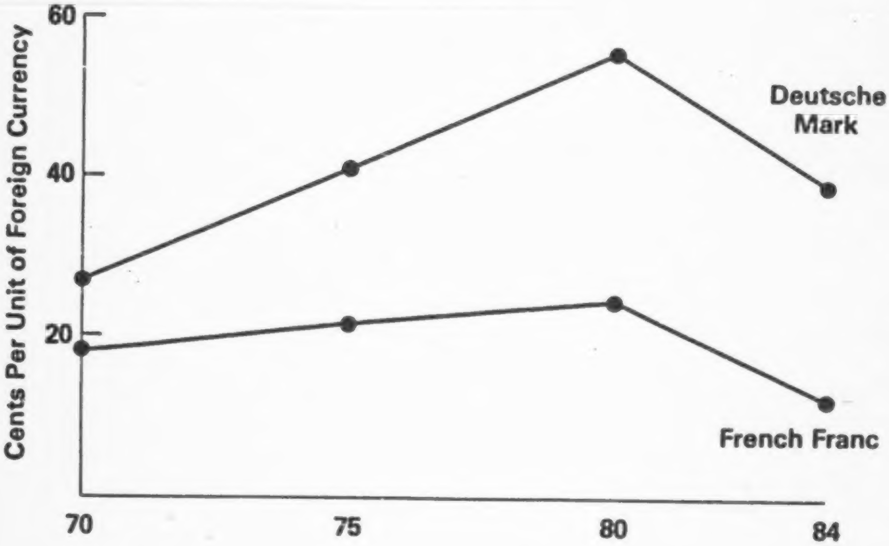
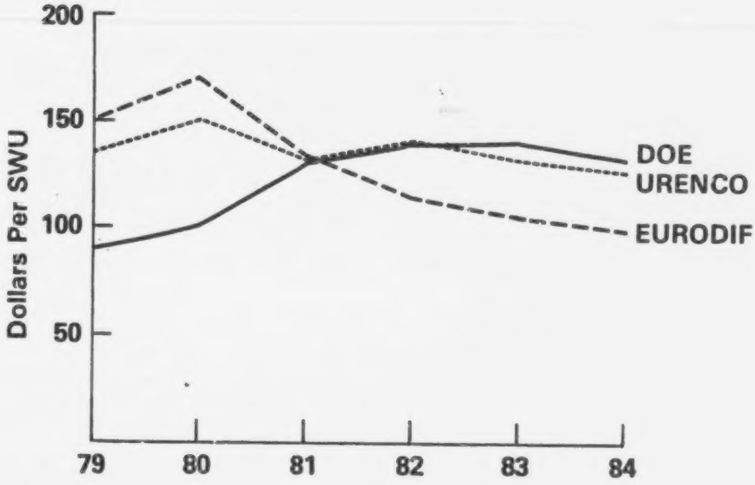


Figure 1 shows the dramatic change there has been in that—the dollar is still strengthening, and we are now in a situation where last week the franc hit an all-time low against the dollar, and is almost now 9 francs to the dollar.

Figure 2

SWU Price History By Supplier



What that has done to price is shown here in Figure 2. Until 1981, we were the lowest priced supplier. It is very important, that one single effect of ours—the rate of exchange—and you can see that has brought us in the past 5 years from being the world's lowest to the world's highest price supplier.

There were other decisions, however, that were also impacting our ability to compete. We believe we can compete despite the rate of exchange difference, but not as the program was structured 2 years ago.

Shelby mentioned the glut of enriched uranium that was on the market, and the secondary or spot market obviously emerged. We estimate there to be on the order of 40 million separate work units that are available on the spot market. To translate that into demand, that is almost 2 years' supply for the entire free world.

That is being sold at whatever price it can derive in the marketplace, substantially less than our price, or of our primary competitors. And when they had contracts that were so inflexible with our customers that in the long term we would have forced them to take additional material, we would, in fact, have fed the spot market.

Dr. WHITTENBURY. John, we do not have the freedom of buying that material and reselling it, is that correct?

Mr. LONGENECKER. We have eliminated that. There is a question as to whether under the Atomic Energy Act we would be permitted. Our assessment is that we would not.

Mr. LEE. You mean DOE?

Dr. WHITTENBURY. U.S. DOE specifically, yes.

Mr. LONGENECKER. Well, that describes a bit of the problem. I would like to tell you how we went about analyzing it and developing a strategy. We began in 1983 to look at the overall situation. We began with the classic question of does the U.S. Government want to be in the uranium enrichment business and what are the benefits of having the uranium enrichment enterprise in the United States?

Having analyzed that, for a nontrivial amount of time, we came to the conclusion that there were important benefits to the country to having a strong uranium enrichment industry. We then moved on to say what should that industry be, what is it today, what do we want it to be at sometime in the future and then what are the actions we need to take to achieve that end?

In the initial step, it was obviously to stabilize the marketplace. With customers leaving us in large numbers—and, again, to define more precisely what that meant—we project in fiscal year 1986 that 95 percent of our deliveries will be to our fixed commitment customers. Only 5 percent of our deliveries will be to our requirements customers.

So that says that most of the requirements customers, who are the only outlet for the secondary market, are buying almost all of their needs on the spot market. To stabilize the marketplace, and define near and long term our customer base, and at the same time draw down the excess inventories that exist, we took the first key step of issuing the U.S. contract. That is in furtherance of our overall objectives in the strategy, and as Shelby described, to be more responsive to our customers and to stabilize the market.

Now, I would like to describe—I would like to tell you what the strategy that is behind the U.S. contract, behind the other supply side decisions that we have made. First of all, a driving objective for the enterprise, is that we are going to firm up our market share and have a competitive industry in the United States—is to be responsive to the needs of our customers. That means listening to them and serving them well, and informing them and making them part of our management process.

We have not, through our contracts or through our interactions with our customers, in the past been as responsive as we should be. That derives from being a monopoly and being part of the U.S. Government. But it is our first objective to be responsive in the future to the needs of our customers.

Second, to be a reliable long-term supplier at predictable prices. Now, that obviously is important, both from a policy point of view and from an economic point of view. The new contract is again a principal element in that strategy by operating at a ceiling. But also by indicating the way that we do business, that the real price of enrichment services in the future to our customers should be declining.

The next element of our strategy was to offer enrichment services at the lowest reasonable price based on sound business practices. Obviously, we have the ability, we have had the ability in the past, being a monopoly, to set the price. We are still the price leader. And with that, we could then set our business practices for other than being competitive at world market. We no longer have that luxury. So we took as a primary objective to offer services at the lowest reasonable price on sound business practice.

And, finally, to operate the enrichment complex without Federal subsidy. Now, that is again in the context of the Atomic Energy Act, which says that we will recover appropriate cost over a reasonable period of time. We believe that we can meet these three objectives and still meet this. They are not incompatible or inconsistent.

Now, underlying all of this is our desire to compete in the world market. And if we do these things, we don't believe that we need to do predatory pricing or predatory marketing or any of the other types of activities to be able to compete. We think by being responsive to customers, by having predictable and low prices and by having prices that decline in real terms over time, we will compete for a large share of the U.S. and the foreign market.

So those four elements, those four objectives, define our strategy to retain the viability of the industry and to regain the competitiveness that we have lost in the past.

We spoke about the new contract. We have issued that. It is an element of our strategy which embodies all of those objectives. Importantly, we have made the U.S. contract development a cooperative effort with our customers, with the industry, and we have spent nearly a year fashioning that contract to assure that it would meet the needs of our customers, both near term and have the flexibility to take care of further customer needs as they evolve.

We know that customer needs have changed in the past. Obviously, the industry is not in a stagnant situation. As it changes in the future, we want to be able to compete.

From those overall objectives, then, our strategy that we evolved has three key elements. The first is the contract we have described, and we will spend some more time on that today.

But the second, very importantly, to meet those objectives, the second element of our strategy was to plan and conduct all of the activities of uranium enrichment in a cost-efficient manner. When we were a monopoly, and we could establish our price at our discretion, that was not as important.

We found in a competitive environment, it was crucial to our strategy to show our customers, one, that we were committed to operating all elements in a businesslike and cost efficient way, and, second, that it is crucial to our getting our near-term price down.

The third part of our strategy, then, was after having taken the first two actions, to initiate actions to encourage private sector interest and participation in uranium enrichment. Privatization is a goal of this Administration. We want to move toward that goal by getting private sector capital involved in the program and getting the private sector involved to the maximum extent possible.

So, to review the items again, the key elements of the strategy are issuance of the new contract, initiation of actions to plan and conduct activities in each business element in a cost efficient way, and finally initiation of actions immediately to encourage private sector interest and participation. There is a clear linkage between those two, obviously.

The key first step was the U.S. contract. It will stabilize the market we believe by the terms that it offers. And most importantly, it is going to define our market share for the next 10 years and give us a firm planning base.

That is so crucial to us, the definition of the market, because we have got to make key decisions on the uranium enrichment enterprise in the next few years, including how much production capacity that we should be maintaining. We have 27 million SWU's of capacity now. We will be selling approximately 14 to 15 million SWU's this year. So, obviously we have tremendous overcapacity.

Furthermore, we have large inventories of pre-produced enriched uranium which is causing us to operate the gaseous diffusion plants at about 35 percent of their full capacity.

The second key decision we have to make is the total amount of power we are going to purchase and from what source. We need to make a decision on the timing for the phaseout of the production capacity from gaseous diffusion plants. And we need to make decisions on when we are going to need replacement capacity and at what cost, what production cost capacity must meet.

So all of those key decisions are driven by the market. They are driven by the definition of our customer base from the customer acceptance to the utility services contract. We believe that it will put supply and demand back into balance.

We see the secondary market, we hope that the access will be committed before the next decade—we believe in the 1988 to 1989 timeframe that supply and demand should be back into balance.

That raises another interesting threshold decision for us. What that means is as long as the secondary market exists, and as long as we are permitting customers to obtain part of their product from that, to stabilize supply and demand, our production levels over the next 3 to 4 years will be artificially low. Then once supply and demand normalize, our supply to our customers could increase, could almost double within a 3-year period.

So, flexibility to meet future demand is also an important consideration. We must be able to meet the near-term demand when it will be artificially low. But, obviously, we are contractually committed and must be a reliable supplier once supply and demand stabilize in the 1989 to 1990 timeframe.

Customer response to the contract to date has been very positive. We have had about 85 percent of our customer base, and that is on a per gigawatt of capacity measure, who have committed to convert to the new contract, it is by signing it, giving us a letter of intent or making a verbal commitment. The contract conversion period closes September 30 of this year, and after that time, we will then assess the contracts and derive from that this basic set of market data on which we can make long-term projections.

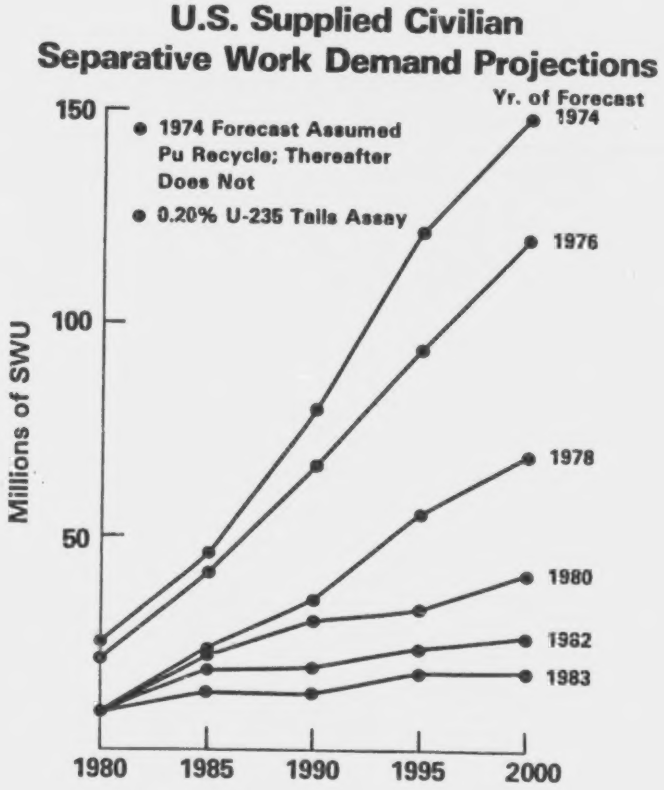
We think that the response to the contract to date indicates that this contract is going to meet the needs of our customers. We are gratified with the response we have had to date.

Mr. MEAD. Will you get the other 22 percent?

Mr. LONGENECKER. Our goal is to get 100 percent realistically speaking, since a large portion of our market is European. If I had to project today, I would say probably 85 to 90 percent of our existing customer base will convert to the U.S. contract.

One blip you will see in the chart, when you see our demand for capacity, there has always been a decline in our foreign market, in the early 1990's, from the European countries, who signed contracts with us before their capacity was already on line, and who have already given us termination notices with the intent of buying from URENCO.

Figure 3



Now, we have centered the strategy around making realistic market forecasts to assure that we are not penalizing ours or our customers by carrying excess capacity for demands that will never materialize. You know that in the past, one of the things that we have done and has been subject to an extensive amount of criticism in the entire nuclear industry, is making unrealistic forecasts. You can see, if you look at the estimates over the last 10 years, how they have changed, from 1974 to 1983 (figure 3).

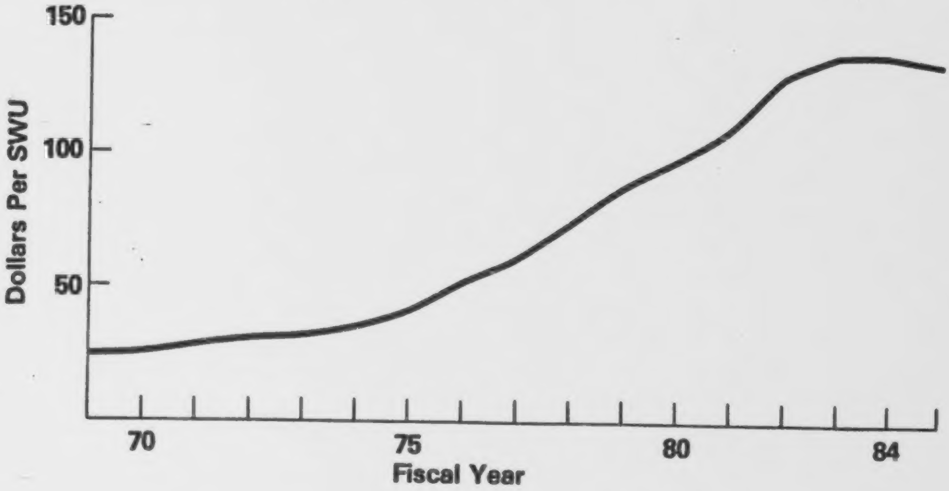
We would project today, before the closing of the conversion period to the U.S. contract, that our demands will increase only slightly in the future. You notice the shape of the 1983 curve. That is primarily the shape of the curve that we are now projecting.

Our estimates of the demand that we will serve at this time are slightly lower than Energy Information Administration's estimates. So we have gotten better at estimating. We need to get even better in the future. But we are now planning our overall business enterprise analysis around the slight growth in our overall market share between now and the turn of the century.

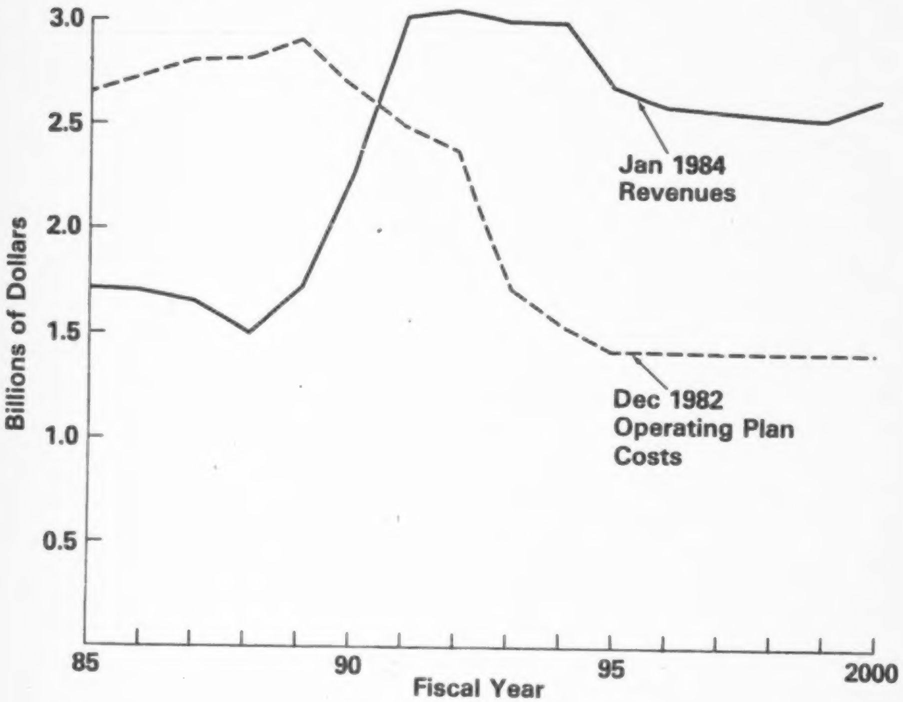
I would return again to what it is that is going to make us competitive. We need to offer favorable price and flexible terms, estimate accurately and get our production capacity in balance with the overall customer demands, and that will allow us, we believe, in real terms, in the future, to offer a lower price.

Figure 4

Historical Uranium Enrichment Service Charges



Projected Enrichment Costs & Revenues



That is contrasted to what our price has been in the past. We have been in business 15 years, and this is a year of the expenditure of dollars. Now our price has gone up by a factor of five (figures 4 & 4a).

A dramatic point is that in 1984 to 1985, our price did decline. It was $138 for customers in 1984; in 1985, it will be $135, and it is our firm intent and our commitment to our customers to manage the business in a way that allows that price in real terms to delcine.

That curve represents, I believe dramatically, the change in our overall strategy. The previous strategy for the past 15 years of how we got to the point of having the price increase by a factor of five is due to how we do business.

The 1982 plan estimated outlays for research and development in GCEP construction, construction of new capacity that exceeded $1 billion per year in some of the next 10 years.

In 1982 and 1983, we spent almost $600 million for GCEP construction, almost $100 million per year for research and development and expended all of that. That is to say that those funds that we outlayed in each year were taken from revenues, added to that year's price and charged to customers.

Due to R&D and construction of the new capacity program, our price escalated very rapidly. Had we continued that, our price would have reached $200 per SWU within the next 2 years. That would have been unacceptable to our customers , so we had to scale back our costs and look at the basic decisions we made for increasing new capacity.

The previous strategy that we had was not market driven. That is a key difference between the strategy that we have now undertaken, and past strategy. The previous strategy was technology driven.

We had the world's most advanced technology and still do. We were planning to deploy that on the assumption that our price would stay below enough in contrast to our competitors to allow us to introduce more cost-efficient technology in a timeframe that was timely and would ultimately allow our prices to begin declining once that new capacity was on line.

That strategy did not work. We were ineffective in getting technology out of the laboratory into production, and the dramatic change in the rate of exchange with our foreign competitors did not allow us the flexibility to continue raising the price.

So our previous strategy was clearly technology driven. It was one of having a new technology and building new capacity to displace old capacity.

Our new strategy, to be competitive, we believe, must be based around being totally market-driven. The first element that we have in reducing cost, however, is not the new technologies. Those are plants that need to be capitalized and built.

We need to find funds to finish the R&D before we can deploy those. We need to see that price come down immediately and decline in the near future, say, over the next 5 years.

That leads us to the conclusion that the only way to achieve that end is to reduce the costs involved with operating the existing production capacity. We and our contractors are making vigorous attempts to obtain cost savings in every program element and the biggest block of funds that we spend on an annual basis is for power.

You will be hearing more about the attempts that we have to search for alternative sources of power and to lower our average power cost for production.

We have substantial outlays for operation of the gaseous diffusion plants. There are three of them at three different sites, and we are looking at ways for balancing production and sharing costs between the three to reduce those costs.

We have made substantial progress in those areas just over the last 6 to 8 months in shifting power among the gaseous diffusion plants to get our average costs down, and we believe that there is a strong potential for obtaining power at lower costs from alternative sources.

The GDP costs, however, are the economic target that must be bettered by the advanced technologies if they are to be considered for deployment.

Although the gaseous diffusion plants are very power-intensive, although they are over 30 years old and use the most power-intensive technology that exists, we set a clear economic goal for the advanced technologies, that they have got to better the costs of the gaseous diffusion plants by a reasonable margin before a decision can be made to deploy them.

Our strategy then includes one other element, a firm commitment that we will continue to pursue effective cost control in the near- and long-term by getting our near-term operating costs down and in the long-term, developing technologies but introducing them when we have proven to ourselves that such introduction will produce lower costs and prices to the customers.

We have discussed earlier today our plan for accelerating the technology decision. You will hear more about that in the 2 days. The funding level of those two programs, coupled with the funding level for continuation of construction at GCEP is a substantial portion of our cash outlays each year.

Continuing GCEP at the $600 million per year level in fiscal year 1982 and 1983 or the $350 million per year level that we have reduced it to in fiscal year 1984, while continuing to carry a R&D program, which in fiscal year 1984 and 1985 is in the range of $150 to $200 million per year, is a very heavy burden on our rate base and is a very large investment for us to make prior to selecting between the two technologies.

We have been supporting and developing the centrifuge technology for nearly 25 years. We have been supporting and developing the AVLIS technology for over 10 years and we believe that due to the high carrying costs of both technologies and due to the large cost of continuing to keep the GCEP project viable, that a fiscal year 1985 decision between the two technologies makes much more economic and technical sense to us than did the previous strategy of continuing both programs through full demonstration to the year 1987.

The primary difference between those two dates is that we will have small-scale demonstration of both technologies in fiscal year 1985. By 1987, we could have had full-scale demonstration of both technologies.

Based on the exhaustive data that we have developed on both technologies, we believe that a high confidence decision can be made and will be made in May of next year.

With regard to construction of new capacity, I have mentioned before our overall objective that if we are going to deploy either of the two technologies, they are clearly going to have to have the effect of reducing costs and the overall price to our customers.

While we are conducting the technology decision between now and May 1985, we are continuing construction of GCEP buildings 1 and 2. We have two buildings under roof and are installing centrifuges in those two buildings.

We are doing that to maintain the project in a viable state. We have an investment in the project at the end of this fiscal year of nearly $2 billion, with the promise of the advanced gas centrifuge technology to offer substantially enhanced economics over the existing generation of centrifuges that we are installing in GCEP.

We believe that that project has the potential for being a very strong competitor for reducing program costs in the future.

However, the final determination on the relative economics between the advanced gas centrifuge and AVLIS will be determined by the process evaluation board that is currently evaluating the two from both the technical and economic point of view.

Until we have the firm conclusions of that board, we believe it is crucial to the enterprise to maintain GCEP in a viable state. We have deferred, however, construction of any capacity beyond buildings 1 and 2, and that was originally an eight-building complex.

Mr. LEE. Have you committed the type of sets to go in both buildings?

Mr. LONGENECKER. We have committed to procure enough of the Set III, the current generation of centrifuges to fill one-half of one building. The reference upon which we are currently evaluating GCEP completion is completing four buildings of GCEP by filling the remaining 3.5 buildings with the advanced gas centrifuge or Set V machines.

The Set V machines are the ones that are currently under development and we will have some demonstration of their performance in the April time frame, next year, for the May 1985 selection.

So, in summary, I have described for you in a very rapid way, I realize, how we got to the strategy. I really believe that if you weigh it against our 1982 strategy, it is a significant departure from past practices.

That departure was required by the demands of the marketplace, but also by a responsibility to our customers. We can operate the program economically and hold costs down and continue to be a reliable supplier within the constraints of the current market.

The strategy, though, is market-driven and relies heavily on continued increasing use of prudent business practices. We are committed to remaining competitive in the uranium enrichment business, both to assure that domestic utilities have a reliable source of low-cost fuel—we are committed to continuing to serve our foreign customers well, and we are also obviously committed to continuing to serve the Nation's defense requirements.

We have not talked about that today, but we will describe it in some detail later.

We are the sole supplier of highly enriched uranium to the Defense Department for naval propulsion and other defense needs. So, it is clear that we are committed to satisfying all the needs in the future, particularly in supplying foreign customers.

There are nonproliferation benefits and balance of trade benefits. Our exports in fiscal year 1983 were over $900 million, to give you a measure of that. We are committed to implementing a strategy of working closely with our customers.

That is a key, to assure that we meet their needs and remain competitive both in the near and the long term. However, that commitment is commensurate with their commitment to rely on us for services and that is the commitment that they make by their conversion to the U.S. contract.

I personally believe that this strategy has significant benefits to our customers, significant benefits to all the electric ratepayers and to the country as a whole.

We remain committed in developing the strategy, though, and implementing it because we have just taken the first step in implementing the strategy to continuing to work with the customers. They have a very important role to play to the industry, and you will be hearing from some of the people who are in charge of planning and operating various of our facilities and various of our research and development programs in the next 2 days.

We are committed also to continuing to work closely with Congress, because the Nation does have a vested interest in a strong uranium enrichment industry and as such, we will continue that close relationship.

We will describe more in detail as we proceed through here what we think the next steps are, and outline for you briefly what the key decisions that we think we need to make are over the next decade.

Clearly, they are how much capacity will we maintain, do we proceed with a GCEP or AVLIS for development or potential deployment, when and on what timeframe do we phase out existing gaseous diffusion technology, and replace it with new technology , and finally, what are the plans, what are the possibilities for achieving privatization of uranium enrichment?

So, we will return to those later, giving those remarks in the broad context. Our objectives are strategy and the key decisions that we see evolving over the next decade. I would like to answer any questions that you have, and then proceed with more detail in each of the program elements that I have laid out for you.

[The prepared statement of Mr. Longenecker follows:]

STATEMENT OF
JOHN R. LONGENECKER
DEPUTY ASSISTANT SECRETARY FOR URANIUM ENRICHMENT
DEPARTMENT OF ENERGY
BRIEFING FOR TRICOMMITTEE ADVISORY PANEL ON URANIUM ENRICHMENT
U.S. HOUSE OF REPRESENTATIVES
AUGUST 16, 1984

I am pleased to be here today to discuss the Department of Energy's Uranium Enrichment Program. I will focus initially on the major elements of the Department's enrichment strategy and then describe in some detail our plans for implementing that strategy.

In previous testimony, the Department has described the complex and interrelated problems that were frustrating the attempts of the Department to be a reliable, low priced supplier of enrichment services. Over the last several years, the DOE share of the world enrichment services market has dropped significantly. A worldwide glut of enriched uranium, the emergence of a secondary market of relatively low-priced enrichment services, the perception that DOE's existing contracts were too inflexible, and the drastic change in currency exchange rates, as shown in Figure 1, have adversely impacted DOE's ability to compete with other suppliers. This history is depicted in Figure 2 which shows that DOE has gone from a position of being the lowest priced supplier to the highest priced supplier in the last four years. In 1983, we analyzed this situation carefully and developed a modified strategy to improve our market position. The purpose of the revised strategy is to stablize DOE's market share by providing for an orderly drawdown of excess inventories of enriched uranium and to stem the tide of customers who are going elsewhere for their enrichment services.

Overall Objectives

The overall objectives of the Department's enrichment strategy are as follows:

1. To be responsive to the needs of our customers.
2. To be a reliable long-term supplier at predictable prices.
3. To offer enrichment services at the lowest reasonable price, based on sound business practices.
4. To operate the enrichment complex without Federal subsidy.

Strategy to Retain Viability of Competitiveness

The DOE strategy responds to the current market conditions by offering a new contract to our customers, offering more attractive pricing, taking steps to dramatically improve relations with our customers, and allowing the market response to the new contract to drive decisions on possible investments in new capacity which can further reduce costs.

Our strategy involves three key elements: (1) issuance of a new contract responsive to customers' needs; (2) initiation of actions to plan and conduct the activities in each business element of the enterprise in a cost efficient manner; and (3) initiation of actions to encourage private sector interest and participation.

There is a clear linkage among the items. The recent issuance of the new Utility Services contract should stabilize and define DOE's market share for the near and long term. Customer response to the contract will provide hard data on market share and will be a key factor in decisions on operational issues such as the amount of production capacity required, total power to be purchased, timing for phaseout of existing capacity, and need for construction of new capacity.

Utility Services Contract

The Utility Services contract was issued to our customers on January 18, 1984. The key elements of the new contract are:

1. Shorter lead times (180 days) to firm-up delivery quantities
2. Ability to offset a portion of requirements by purchase from the secondary market
3. Ability to purchase a portion of requirements from foreign sources, if desired
4. A competitive price for separative work both in the near and long term with price protection via a price ceiling
5. Flexibility to select variable tails assay option
6. Flexibility to terminate contract with no penalty with 10 years advance notice to DOE

Overall, the new contract offers significant advantages to all of our existing customers and to prospective new customers. Fixed Commitment customers obtain the ability to convert to a Requirements-type contract, obtain partial relief from their existing contractual future year delivery commitments, and obtain means for working off their existing excess inventories. Requirements customers obtain a lower price from DOE and the ability to purchase a portion of their needs from the secondary markets potentially at an even lower price. Also, Requirements customers obtain access to the use of the variable tails assay option which they do not currently have. DOE believes that this contract offers enough beneficial features to our customers to obtain a high rate of conversion.

Customer response to the new contract has been extremely positive. To date, over 85 percent of our customers have either signed the Utility Services contracts or have indicated their willingness to convert. We are very pleased with the progress made to date, and believe that this response indicates that the new contract meets the needs of our customers. Once our customer base is determined by conversions to the Utility Services contract, a cost efficient and competitive program will be implemented and maintained to meet this market. Most important, with the Utility Services contract, we have centered our strategy around satisfying realistic demand for enrichment services, and thus can avoid repeating mistakes made in the past, as displayed in Figure 3 that were based on contractual commitments substantially in excess of customers' real demand for services.

Control of Program Costs and Customer Prices

A key to remaining competitive in the marketplace is the offering of a favorable price and flexible terms for enrichment services. Over the past 15 years, DOE's enrichment prices have increased by about a factor of five, as shown in Figure 4. Continuation of the previous strategy with large outlays for gaseous diffusion plant (GDP) operations, GCEP, and advanced R&D would make it difficult to offer competitive prices to our customers in the near term and would not generate a high level of confidence with them that we are serious about price stability or price reductions in the long term. Accordingly, we are undertaking a vigorous cost reduction program with two key elements.

The first element of cost reduction involved the operation of existing production capacity. DOE and its contractors are making vigorous attempts to obtain the lowest cost power available, to reduce outlays for GDP operations, and to operate the existing complex in the most cost efficient manner possible.

As you will hear in subsequent briefings, we have already made substantial progress in these areas. The GDP costs serve as the economic target that must be bettered by the advanced technologies if they are to be considered for deployment. Our strategy includes a firm commitment that we will pursue effective cost control both in the near and long term. This commitment is made real by the offer of a cost ceiling in the new contract.

The decisions also will be market driven. The scope and pace of the R&D activities, and decisions to add new capacity, will be made based on reactions from the marketplace through acceptance of the new contract and through future trends of price competitiveness and competitor actions. In the near term, our strategy includes a commitment to developing and deploying new technologies when economically feasible. The funding level and pace of these programs, however, will be based on a more businesslike approach that will be determined by market share, revenue availability, and the potential of advanced technologies to lower costs.

In the near term, DOE is conducting research and development on both the advanced gas centrifuge and AVLIS processes. A detailed technical and economic evaluation of the two processes is underway. This evaluation is assessing the economic feasibility and economic potential of both advanced options. DOE's objective is to determine the relative merits of pursuing each technology through the demonstration and deployment stages. It is our objective to be in a position to make a decision in May 1985 on which technology should be pursued for potential deployment. You will hear more about our program for this selection in presentations during the next 2 days.

With regard to construction of new capacity, the Department intends to proceed in FY 1985 with construction of Buildings 1 and 2 of GCEP. Construction of any capacity beyond Buildings 1 and 2 will be deferred, and we are now rescoping the GCEP project to minimize overall costs and procurement of centrifuges.

Summary

In summary, the new uranium enrichment strategy reflects a departure from the past practices. The strategy is market driven and relies heavily on proven business practices. The Department is committed to retaining a competitive stance in the uranium enrichment business to assure that domestic utilities have a reliable indigenous supply of fuel and that defense requirements are met. We remain committed to satisfying the needs of foreign nations to assure furtherance of nonproliferation objectives. We will work closely with our customers to assure that we meet their needs, and we will commit to meet their long-term needs commensurate with their commitment to DOE to continue to rely on us for their enriching services.

I believe this new strategy will have significant benefits to our customers and their ratepayers, and to the country as a whole. We remain committed to working with the industry and the Congress to assure that the uranium enrichment enterprise is responsive to these objectives.

Figure 1

Foreign Exchange Rates

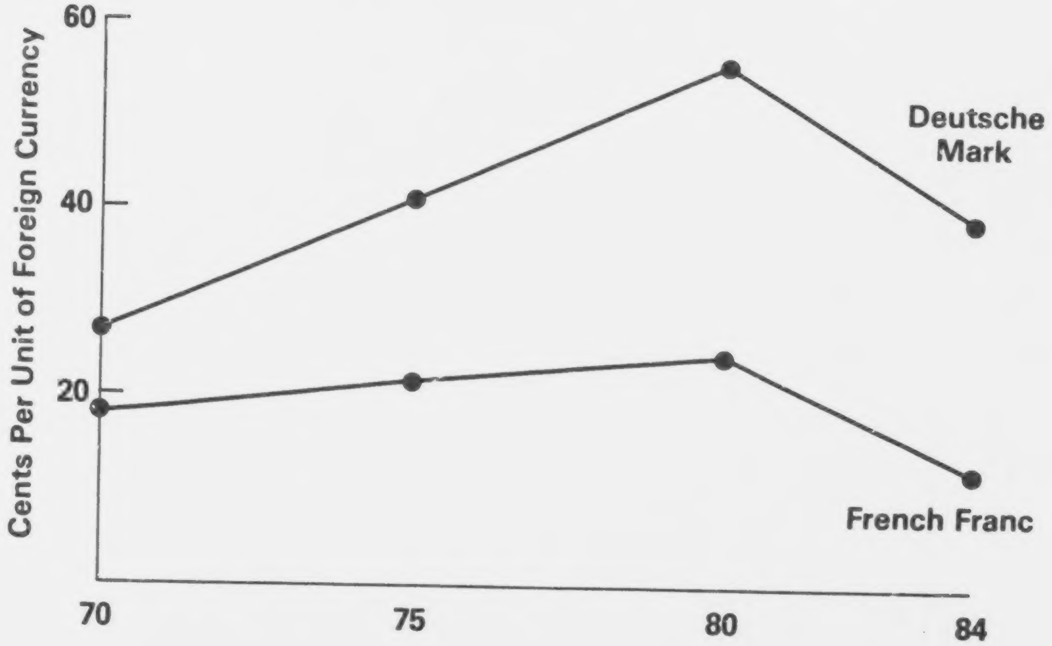


Figure 2

SWU Price History By Supplier

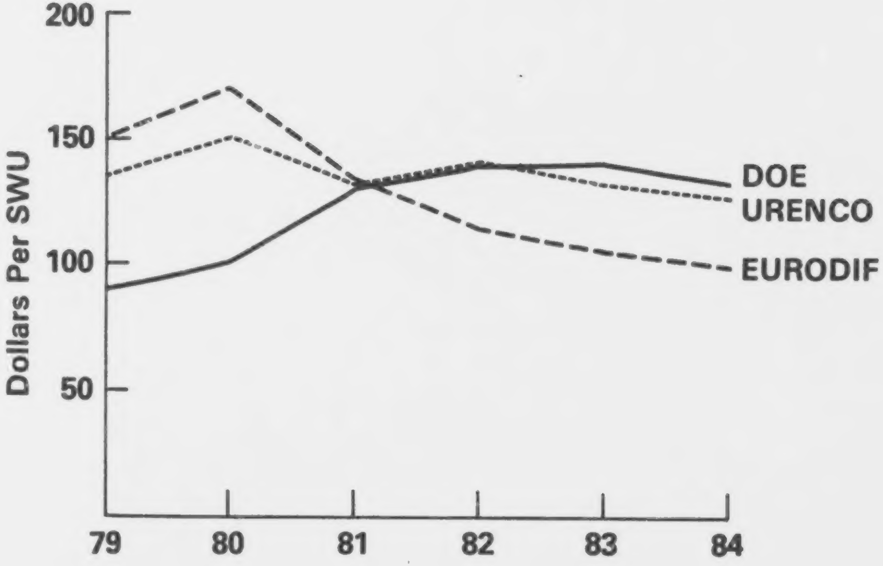


Figure 3

U.S. Supplied Civilian Separative Work Demand Projections

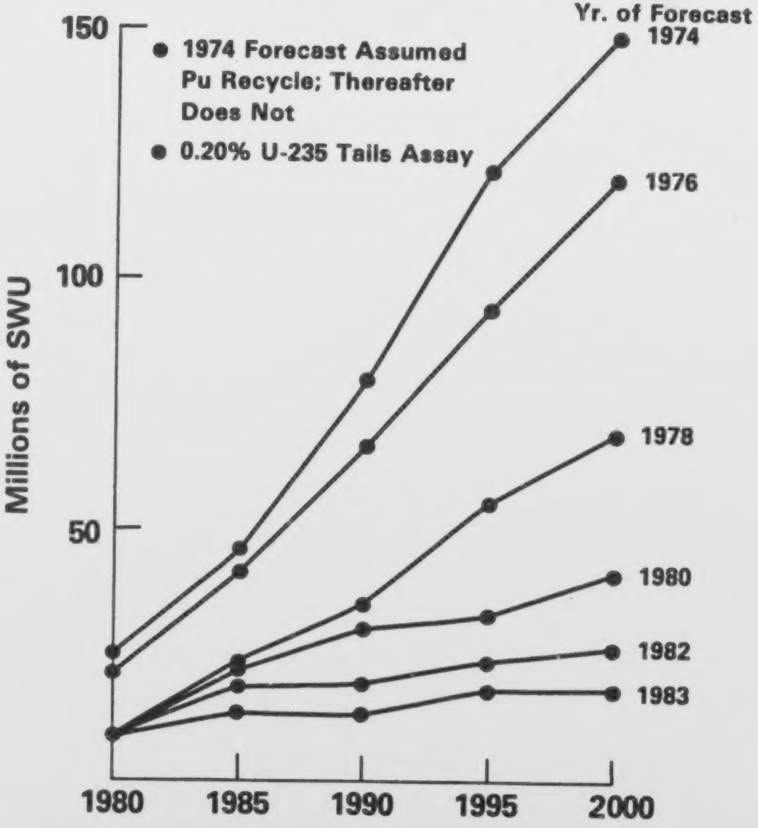
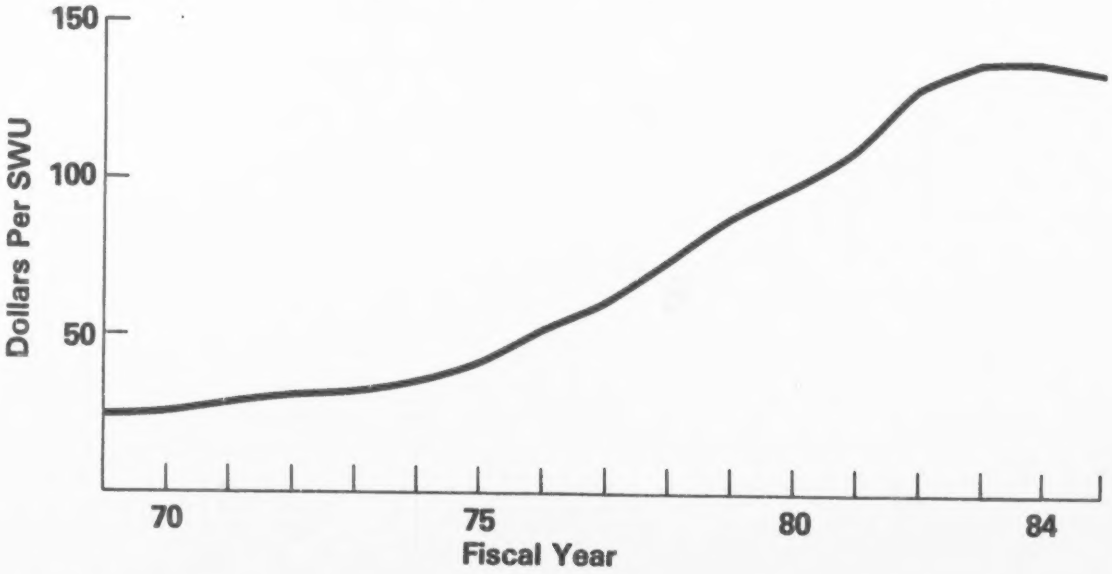


Figure 4

Historical Uranium Enrichment Service Charges



Mr. **Lee**. Let's have questions of John Longenecker.

Mr. **Potter**. At another part in your presentation, will you cover what the commitments are of your organization under these new contracts?

Mr. **Longenecker**. I am not sure I understand the question.

Mr. **Potter**. That is, you are converting 90 percent of your contracts to this new contract, the U.S. contract, and pursuant to that contract, you make certain commitments to deliver products and our advice would be constrained by what commitments exist to that.

Mr. **Longenecker**. Yes, we will be covering that.

Mr. **Barker**. Somewhere along the line, will you be covering the part of the strategy that you have assessed that the competition has, how you stack up against the competition, will that be part of it?

Mr. **Longenecker**. Yes, sir. That is an important element. We obviously measure our strategy against what our competitors do, and that also will change in the future, obviously. That will be evolving.

An important element of this is not only to set this strategy and to then go forward with it or set a 10-year operating plan and proceed, but we, through our annual planning process, will measure that and adjust the overall strategy.

The communication of that to Congress comes in our annual budget submissions. We will be describing our 10- or 15-year planning horizon, but it is important when you see those that we measure those continuously and every year update those and adjust our strategy as necessary.

Dr. **Bohn**. You have a good idea of 10-year demand forecasts worldwide. Can you give me some estimates?

Mr. **Longenecker**. Let me state that if I could, in free world sales, because this is the market that is there for we and any of our competitors. In 1985, we estimate that the total free world consumption of separative of work is about 20 million separative of work units, slightly over that.

Dr. **Bohn**. This is consumption, not sales?

Mr. **Longenecker**. That is correct. By 1990, current estimates would show that increasing to about 30. By 1995——

Mr. **Mead**. That is worldwide?

Mr. **Longenecker**. Free world only. By 1995, we would estimate in the range of 38 to 40.

Mr. **Brewer**. To place those figures in context, the world capacity is about 42 million SWU's per year, so we have got just about a factor of two over capacity.

Mr. **Mead**. That consumption, what percentage of that is United States?

Mr. **Brewer**. In 1990, it is about 12 million SWU's United States, and 18 million SWU's non-United States, for a total of about 30.

Mr. **Mead**. In 1995?

Mr. **Longenecker**. I am sorry, I don't have the 1995 breakout, but I can provide that to you. We base those projections primarily—these are done independently and we do have a rather comprehensive system of gathering data on our customers and making estimates.

Mr. LEE. These numbers you are giving on United States are civilian sector only?

Mr. LONGENECKER. Yes, sir. They do not include any defense requirements. We generally view our market projections as being based on essentially new no orders through the year 2000, so that you see are some of the deliveries that we anticipate making.

We currently have 277 contracts. Obviously not all of those are live. Many of those reactors have been terminated or deferred. But, it is based on serving primarily those customers whom we have and will continue to have with operating reactors under those 277 contracts.

To put that on a gigawatt basis, we have 289 gigawatts under contract. We project that we will be serving in the year 2000, to give you a measure of the amount under contract versus the amount that we will be serving, with the 289 gigawatts under contract, we estimate that we would be serving about 175 to 180 gigawatts in the year 2000.

You have seen our demand projections and how they have been updated every year. That gives you an idea both in SWU's and in gigawatts as to what we think our customer base is measured today.

I, again, emphasize that this is based on preliminary projections of conversions to the new contract. We have, we believe, a reasonably good base on the reactors, and the current status, the probability for them being completed and operating reliably.

We still must ascertain from the conversion of the U.S. contract how many of our customers will continue to buy from us, and for how long, and at what percentage of their requirements between 70 and 100 percent.

So, we will modify these projections based on the returns from the U.S. contract.

Mr. LEE. You mentioned a moment ago free-world consumption.

Mr. LONGENECKER. Yes.

Mr. LEE. Let's make sure we understand consumption. Is that delivery of SWU's to the customer or the burnup of SWU's consumed?

There is a year or two lag between the two.

Mr. LONGENECKER. That is burnup.

Mr. MEAD. Actual?

Mr. LEE. So, tables 2 and 3, attacked to the interim working scenario paper given to us, are deliveries of SWU's which are somewhat higher in delivery to the American sector than the 12 million SWU's consumed that year and that is understandable, because it takes a while to make this stuff.

Mr. LONGENECKER. Yes; you are seeing our estimated deliveries in any given year in that interim working scenario.

Mr. LEE. Thank you.

Mr. LONGENECKER. Other questions?

Mr. LEE. Are you going to return to the impact on cash-flow of an early versus a later decision on advanced technologies?

Mr. LONGENECKER. Yes, I will. I will return to that later in the day today. To give you a rough estimate of what that is, take the 1987 number, and assume that you continue to carry GCEP for 2 more years at $350 million a year, that is $700 million, and you continue to carry both technologies at the rate that was prescribed for the 1987 decision, that is another—in addition to the 1985 decision, that is another $300 million, so it is $800 million to $1 billion by carrying it for another 2 years.

Mr. LEE. At the 1984-85 level?

Mr. LONGENECKER. That is the difference between making a decision in fiscal year 1985 versus making it in fiscal year 1987 would require us to make additional outlays on the order of $1 billion in that timeframe.

Mr. LEE. And if you postpone the decision for 1 year, as was suggested by Congresswoman Lloyd, can this committee assume that you would be talking about a $500 million decision?

Mr. LONGENECKER. On that order. It is not quite as large because you have the carrying cost of GCEP, which is—again, we are assuming that it were carried at the same rate as you carried it in fiscal year 1985—the fiscal year 1986 decision date, however, would not allow you to do full-scale demonstration of both technologies.

That would not be as capital-intensive, but at the same time, you would not have achieved the stated objective of full-scale demonstration of both, so you would not spend as much on technology.

So, it is probably less than half a billion dollars, but it is in the range of $400 million-plus.

Mr. LEE. If you do make the decision in May of 1985, and you select one of the advanced technologies, does your forward projection beyond that keep the other technology alive and on the back burner as a backup?

Mr. LONGENECKER. There are two different parts to that, depending on whether you pick AGC or AVLIS. The answer is "yes" in both bases, you maintain the other technology. In the case of an AGC wins scenario, AVLIS is clearly an advanced technology that has some potential, and it does become an advanced option.

If AVLIS were to be selected, GCEP—excuse me—advanced gas centrifuge technology then becomes a backup that you would carry until such time as you had done full-scale demonstation of AVLIS and were certain that it were viable.

Obviously, if we selected AVLIS, we would not continue the advanced gas centrifuge program for a long period of time.

Mr. MEAD. But you would keep the two buildings going?

Mr. LONGENECKER. We would have to make a decision as to how much of GCEP to complete. That is a significant decision, and it does have to do with the results of the evaluation board's deliberations of the AGC economics, how economical can we make GCEP?

Mr. LEE. So, the May 1985 decision that you propose to make at that time would be which of those technologies you are going to rely on for replacement capacity to replace the diffusion plants?

Mr. LONGENECKER. Yes, sir.

Mr. LEE. When that replacement is justified?

Mr. LONGENECKER. Yes, sir.

Mr. LEE. And the other technology would be carried along, continued to advance somewhat as a backup?

Mr. LONGENECKER. Correct, either as an advanced technology option or as a backup. There is a slight difference between the two.

Mr. LEE. And there is a difference in timing in which they come into place in the scenarios that you have given us in the table.

Mr. LONGENECKER. Yes, sir.

Mr. LEE. And again, a 1-year delay in the May 1985 decision would cost $350 to $500 million?

Mr. LONGENECKER. Well, those are the additional outlays that we would have to make during that timeframe, which may be put in jeopardy. If you pick the centrifuge option in fiscal year 1986, you would not have nonbeneficially used the money for GCEP, because obviously, that would apply, you are going to finish it.

If you pick, at last you potentially have put all of that investment in jeopardy.

Dr. BOHN. This is the $350 million a year as continuing to stage 3 centrifuges into GCEP?

Mr. LONGENECKER. The $350 million is the number that I said hypothetically were you to fund the project that is the fiscal year 1985 level, and what that provides for is about $120 million to produce centrifuges, is roughly how that breaks down.

There is about $40 million to startup costs in that because we are going to be starting up the first train in GCEP in fiscal year 1985, so there is $40 million startup. There is construction money in there, about $45 million in round numbers. About $50 million in engineering, and $40 million in procurement of goods and services.

And there is about $55 million in what is called technical support to support the facility. So that is how it breaks down. So that $350 million does include construction, some procurement and a lot of engineering moneys, but that is the carrying cost of the project in fiscal year 1985.

Mr. LEE. Other questions at this point?

John, continue.

Mr. LONGENECKER. All right, Bill.

I would like to introduce Don Gestson, who is my deputy, who will give you the truncated uranium enrichment primer.

STATEMENT OF DONALD K. GESTSON, DIRECTOR, OFFICE OF URANIUM ENRICHMENT

Mr. GESTSON. I am passing out copies of charts I will be using. I will try to put in perspective some of the terms that you have heard and get into a little bit of definition that you will be hearing, and have not been exposed to so far today.

Starting with the nuclear fuel cycle, I would like to point out that enrichment is in the center of the nuclear fuel cycle and is considered a total enrichment service in that the material going through the cycle is owned by the customer.

In the case of the one exception, the depleted storage from the depleted stream from the enrichment plant is the property of the customer if he arranges to take it. If there are no arrangements made, then the property of the depleted uranium reverts to the Government, and most of the customers let the ownership revert to the Government, as most of the depleted uranium that has been produced.

For the most part, this is a private sector endeavor. The two exceptions are the uranium enrichment services which are government, and the long-term spent fuel storage.

The balance of the cycle is private sector. You have heard about several technologies. We have three enrichment technologies that we are currently using.

The gaseous diffusion technology, which has been in production for nearly 40 years involves diffusion of gas through a barrier to separate uranium 235 and 238 primarily by their weight.

There is a large gas flow involved, and as a result, there is a high use of electric power. The gas centrifuge (GCEP) technology, which is being used in the construction of the gas centrifuge enrichment plant in Portsmouth, OH, also separates largely on the basis of weight, but here, the separation is done by centrifugal force.

The centrifuge process is a very small user of electric power. The atomic vapor laser isotope separation process is under development. It separates the isotopes by exciting the U^{235} component and removing it by electric attraction.

As a result, it is not weight dependent. The AVLIS process is also a small user of electric power.

Dr. BOHN. How many kilowatt-hours per SWU are we talking about for gaseous diffusion?

VOICE. 2350.

Mr. GESTSON. You have heard the term separative work or SWU already this morning. The separative work unit is the measure of the output of an enrichment plant. It is the effort that goes into separating the streams.

One stream, containing a high concentration of U^{235}, and another stream containing a lower concentration of U^{235}. The cost of this effort in the case of the gaseous diffusion plants is largely electric power. The cost of the effort in the case of gas centrifuge or atomic vapor laser process is largely manpower and materials.

I would like to show you graphically what separative work units are by comparing it to a cider press. In the case of a normal operation as shown over here, you put one bushel of apples into the cider press, and you apply a moderate amount of muscle or force and the result is one gallon of cider and then a waste stream which consists of the peels, the cores and the seeds of the apples.

An alternative is to apply more muscle or more force, supply fewer apples. In this case, you get more use out of a single apple and the net result is you have less waste.

In optimizing the cider industry, this would be the attractive mode if the price of apples were high. Conversely, if the price of apples were low, they might take an opportunity to use less force and more apple and get the same product, one gallon of cider.

So, it is an optimization process in the cider industry. It is an optimization process in the enrichment industry, too. The tails assay is the percentage or the concentration of U^{235} in the depleted or waste stream.

The assay of the waste stream determines how much feed and how much separative work are required for a given amount of product. To produce one kilogram of 3 percent U^{235} product, which is normally required for power reactors, can be accomplished in a number of ways.

In this case, we show what might be considered the normal operation at a tails assay of 0.25 percent. This requires 6 kilograms of natural uranium feed and 3.8 separative work units. A lower tails assay as you can see requires less feed and more separative work.

Here again, if the price of feed is high, then you would want to go to a lower amount of feed and use more separative work. Conversely, there is the opportunity to go to a higher tails assay and use more feed and less separative work.

Here again, this is an optimization. Our current transaction tails assay is 0.2 percent, and the tails assay can be varied by the operation of the plants.

The new contract that we have offered that has been mentioned already offered, what is called the variable tails option, in which case, the customer can select the tails assay and thereby optimize the amount of feed and the amount of separative work that is required for his product.

To give you a little idea of the size of our enrichment industry, in 1983, we sold 15 million separative work units for a price of $2.3 billion. The assets of the enrichment enterprise as shown in our 1983 annual report are $7.4 billion, made up largely of inventory and capital facilities.

The facilities were built in past years and to replace them at current value dollars would cost $15 billion. We have the—the enterprise has a contractor employment level of 13,000 people.

Some of our major contracts are the Martin Marietta Energy Systems Corp., Goodyear, Airesearch Manufacturing Co., Boeing, and Lawrence Livermore National Laboratory.

These are contractors that you will see during the next few days. If there are any questions, I would like to cover those now.

[The prepared statement of Mr. Gestson follows:]

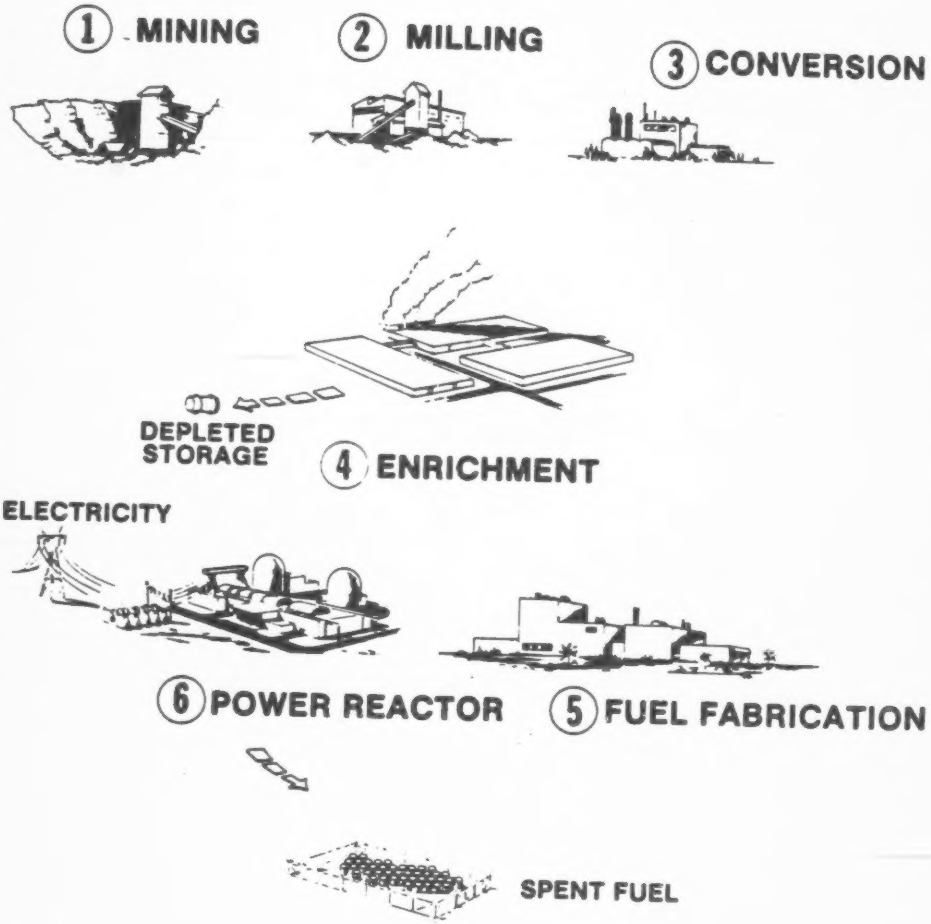
Uranium Enrichment Primer

Donald K. Gestson

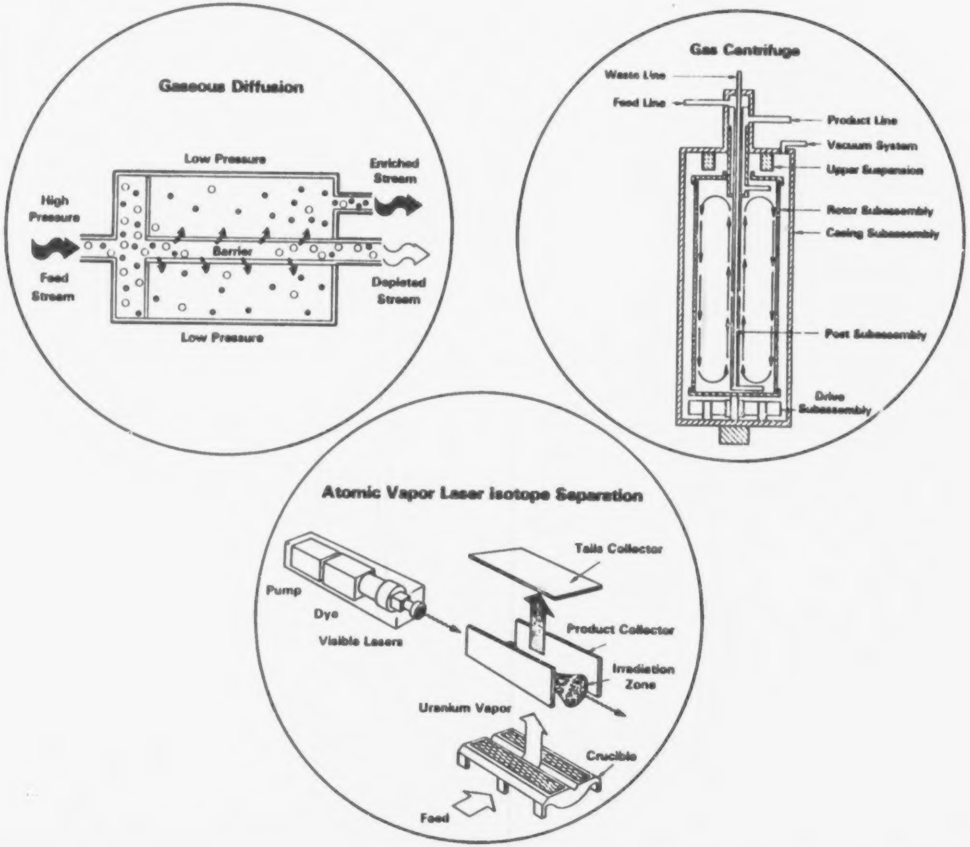
Director, Office of Uranium Enrichment

August 16 & 17, 1984

Nuclear Fuel Cycle



Uranium Enrichment Technologies

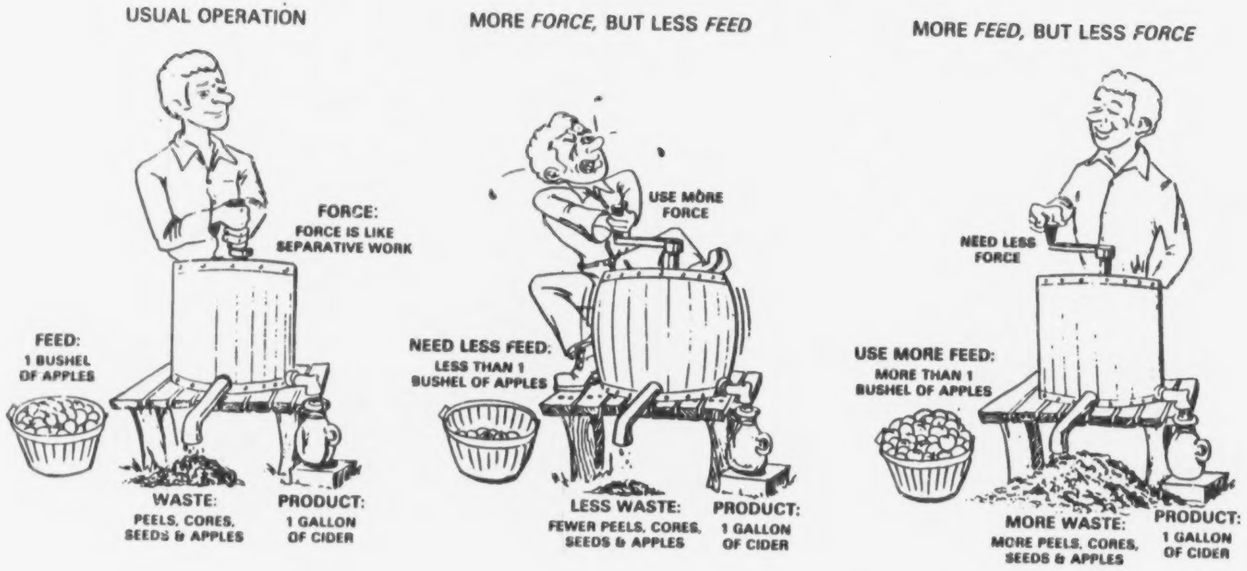


Separative Work Unit or "SWU"

- A SWU is a Measure of the Capability of an Enrichment Plant to Perform a Specified Amount of Enrichment Under Specified Conditions
- A SWU is the Effort Devoted to Separating a Quantity of Uranium Feed Material into Two Fractions:
    1. A Fraction Containing a Higher Concentration of U-235 Than the Feed
    2. A Tails Fraction Containing a Lower Concentration of U-235

Separative Work & Tails Assay Analogy

Making *One Gallon* of Apple Cider


USUAL OPERATION
FEED: 1 BUSHEL OF APPLES
FORCE: FORCE IS LIKE SEPARATIVE WORK
WASTE: PEELS, CORES, SEEDS & APPLES
PRODUCT: 1 GALLON OF CIDER
MORE FORCE, BUT LESS FEED
USE MORE FORCE
NEED LESS FEED: LESS THAN 1 BUSHEL OF APPLES
LESS WASTE: FEWER PEELS, CORES, SEEDS & APPLES
PRODUCT: 1 GALLON OF CIDER
MORE FEED, BUT LESS FORCE
NEED LESS FORCE
USE MORE FEED: MORE THAN 1 BUSHEL OF APPLES
MORE WASTE: MORE PEELS, CORES, SEEDS & APPLES
PRODUCT: 1 GALLON OF CIDER

Enrichment Plant Tails Assay

- Tails Assay is the Concentration of U-235 in the Depleted Stream From an Enrichment Plant
- Tails Assay Determines the Relative Amount of Uranium to be Fed to an Enrichment Plant & the Separative Work Required to Produce a Specified Amount of Enriched Uranium
- To Produce 1 Kg of 3% U-235 Enriched Uranium

	Tails Assay		
	0.20%	0.25%	0.30%
—Natural Uranium (Kg)	5.5	6.0	6.6
—Separative Work (SWU)	4.3	3.8	3.4

Uranium Enrichment Financial Data

● Sales (FY 83)	$2.2 B
● Assets (1983 Annual Rpt.)	$7.4 B
● Replacement Value of Plants	$15 B
● Contractor Employment	13,000

Mr. GESTSON. The next speaker will be Sherry Peske, addressing the marketing and contracts.

STATEMENT OF SHERRY E. PESKE, DIRECTOR, OFFICE OF MARKET AND BUSINESS OPERATIONS, DOE

Ms. PESKE. I will be covering four areas this morning; an overview of marketing, the competitive position of the United States relative to the other suppliers in the world, a brief history of our enrichment contracts and the kinds of commitments that we have under those contracts and then finally a discussion of how we price for our enrichment services.

Market Environment

Sherry E. Peske

Director, Office of Marketing & Business Operations

August 16 & 17, 1984

Character of Current Enrichment Market

- **Large Excess of Installed Enrichment Capacity**
- **Large Surplus Inventories of Enriched Uranium**
- **Limited Number of New Market Opportunities**
- **Fierce Primary & Secondary Market Competition for Existing Market Demand**

The character of the current enrichment market can be summarized with four major elements. There is a large excess of installed enrichment capacity around the world exacerbated by a large surplus of uranium inventories in the world. There is a very limited number of new market opportunities, by that meaning new reactor orders. There are probably only two or three known to happen outside the United States during the next decade and as a result there is fierce primary and secondary market competition for existing market opportunities.

So all of that boils down to the market at the present being very much a buyer's market. One of the things buyers are demanding or looking for in the supplier, they are looking primarily and first for supply assurance.

Market Forces That Influence Buyer Preferences

- **Supply Assurance**
    - **Reliability of Supply**
    - **Diversification**
- **Price**
    - **Current Prices**
    - **Long-Term Price Perceptions**
- **Contract Terms and Conditions**
    - **Quantity/Timing Flexibility**
    - **"Custom Fit" Arrangements**
- **Nationalism/Political Considerations**

The cost of nuclear fuel compared to the size of investment in the reactor is very small, but that investment can be rendered useless if fuel is not there on time so reliability of supply is a very important element to the customer. Diversification is also an extreme element in the market at present, particularly overseas since interruption of oil supplies under the oil embargo made very clear that putting all your eggs in one basket is not a good thing to do.

Price is the primary moving factor in the market, not only current prices, because there is money to be saved by taking advantage of lower current prices, but there are important long-term price perceptions that enter into the mind of the customer.

He is still signing up for a long-term contract and he wants assurances that future prices will be good also. Contract terms and conditions themselves are very important. The customer would like to have quantity and timing flexibility to protect him against changes that may occur in the fuel cycles and he would like custom fit arrangements to any unique situations that he has whenever possible.

Nationalism or political considerations are very important particularly overseas where some of our customers are equity partners in other suppliers or have national reasons for wanting indigenous enrichment supply.

Dr. WHITTENBURY. Who is responsible for this in DOE? What would be the equivalent of the marketing sales department at DOE? Who is specifically responsible?

Ms. PESKE. The marketing effort is primarily the responsibility of the DOE organization headquarters, John's shop and the office head. The contracts themselves are executed by contracting officers in the Oak Ridge Operations Office. That office is responsible for the execution and the administration of the contracts when they are assigned.

We work very closely together.

Dr. WHITTENBURY. You do the marketing out of DOE headquarters?

Ms. PESKE. Yes; now the Oak Ridge people that work with the contracts are a vital part of that marketing effort. It is a team effort between marketing and contracting.

Dr. WHITTENBURY. Who negotiates the actual numbers that go into the contracts?

Ms. PESKE. It is usually a team of experts from the department made up of both headquarters and Oak Ridge people. Some are people in my shop, the lawyers in Oak Ridge, the contract adminisitators in Oak Ridge.

Mr. LONGENECKER. There is an actual group that is designated. There are contract executives for each utility and then they conduct negotiations independently with business and marketing and legal people. Once the contracts are negotiated they come to a board for consideration to assure uniformity and they receive at headquarters—the chairman of that board is Sherry and she comes to me for my approval.

But the contracting officer, the Government part of this is the manager in the Oak Ridge Operations Office. He is officially the contracting officer and signs all the contracts.

Mr. MEAD. He is not the marketeer?

Mr. LONGENECKER. It is a joint effort between us. We have staffs in both locations that are complementary in talents and background. We collectively do the marketing and contracting, but the lead for the marketing is in my organization. The official lead for the contracting is in Oak Ridge, but because of the importance of the two they obviously cross lines organizationally with personnel.

Dr. WHITTENBURY. How many people are on that board?

Ms. PESKE. On the board now there are seven people: Four professionals from the Oak Ridge staff, and three from headquarters use a matrix form of support there. They have direct staff in all enrichment operations of five people.

In addition, there are legal and procurement folks there to assist them. It is relatively small compared to what a private company would have for this kind of sales base.

Dr. WHITTENBURY. That kind of organization might work very well when you have a monopoly. When you have to make tough negotiations how difficult is it?

Ms. PESKE. It is very difficult. We have been working for the last 6 months with the negotiating for the conversions and we are very resource tight, but by teaming together with headquarters and Oak Ridge, making sure the teams have complementary staffs, organizing it well, we have been able to maintain a pretty good pace of negotiating those contracts.

Dr. WHITTENBURY. Do you have any active proposals for improving the way of dealing with the customers?

Ms. PESKE. In concert with the development of the contract, there was a very detailed plan put together as to how we were going to actually negotiate and get through the conversion. We are in the process of putting together a very detailed plan of post conversion, how are we going to assure customer service; what are the rules and responsibilities of each; what is our strategy going to be for each segment of the market?

We have a post conversion plan now in the development stage.

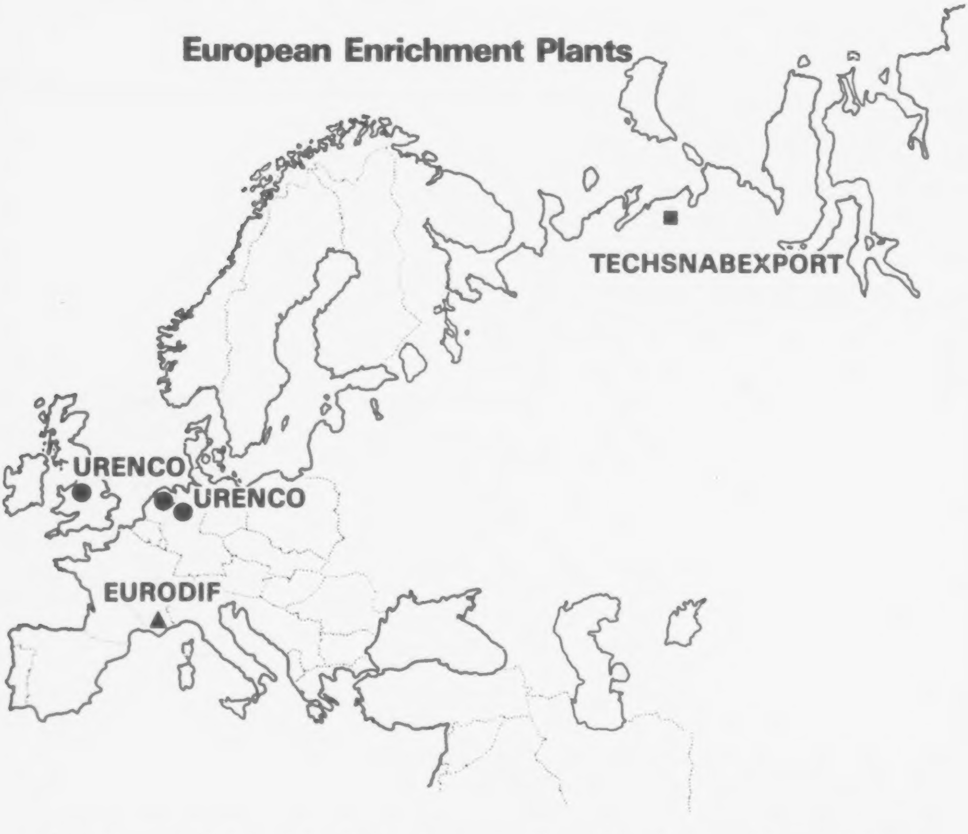
Dr. WHITTENBURY. How many account executives are there?

Ms. PESKE. Eight, maybe ten. I would have to count. But many of them have more than one customer.

Mr. LONGENECKER. We have 90 customers, to give you an idea. We have only 90 individual customers we currently serve.

Mr. MEAD. How many of those are foreign?

Mr. LONGENECKER. Thirty-nine. Fifty-one are domestic and 39 are foreign.



Ms. PESKE. Take a look at the suppliers in the world outside of the Department of Energy. There are three major suppliers, URENCO, which is a consortium of the Federal Republic of Germany; the United Kingdom and the Netherlands, EURODIF, primarily a French-owned consortium; and the Soviet Union through Techsnabexport, which is an export organization for surplus uranium services to the West.

Foreign Competition

- **EURODIF — French Company with Equity Participation from Four other Countries**
  - **—Company Incorporated in Nov 1973**
  - **—Start of Construction in 1975**
  - **—Initial Production in 1979**
  - **—Uses Gaseous Diffusion Process**
- **URENCO — U.K., Netherlands, W. Germany Joint Enterprise**
  - **—Organization Formed in 1970**
  - **—Start of Construction in 1974**
  - **—Initial Operation Late 1976**
  - **—Uses Gas Centrifuge Process**
- **TECHSNABEXPORT — U.S.S.R.**
  - **—Russian Enrichment Plant Built for Producing Weapon-Grade U-235**
  - **—Also Supplies Low-Enriched Uranium for Light Water Reactors in USSR and Soviet-Bloc Countries**
  - **—Surplus Low-Enriched Uranium Has Been Offered in Limited Quantities to Western Utilities**

To look at them in more detail, EURODIF is a French company with equity participation from four other countries. France, Italy, Belgium, Spain, and Iran were the original ones. Iran is in the process of working out of its commitment to the organization. The company was incorporated in 1973, began construction in 1975 and had initial production in 1979. They committed to the plant, moved very quickly and completed construction in the early eighties. They use gaseous diffusion technology.

URENCO, an organization formed in 1970, began construction in 1974, initial operation in 1976 using gas centrifuge.

Techsnabexport, basically exports surplus enrichment services over and above Soviet bloc needs to the West in small qualities, they enter the market primarily as a function of their need for hard currency.

Mr. MEAD. URENCO, using the gas centrifuge process, how does that compare to our own?

Mr. LONGENECKER. Basically it would be comparable to our Set I machine, smaller and less sophisticated, much smaller machines than we currently operate. A simple analogy is it was as if we deployed our Set I machine. It is our understanding that they are working on advanced machines. It is a different technological development program than we have, but it is again our understanding—they are not as open with their program planning and business strategy with us as obviously we are, being part of the government. But our understanding is that they both have technological development programs to increase the output of the machines.

Mr. MEAD. And reduce the cost?

Ms. PESKE. Yes, sir, and concurrently to build additional capacity as the market demands.

Uranium Enrichment Services Competitors

	M SWU/Yr			
• EXISTING COMPETITORS:	1980	1985	1990	TECHNOLOGY
EURODIF (France, Spain, Belgium, Italy, Iran)	6.0	10.8	10.8	Diffusion
URENCO (FRG., UK, Netherlands)	0.4	1.0	2.0	Centrifuge
TECHSNABEXPORT (USSR)	3.0	3.0	3.0	Diffusion
• POTENTIAL COMPETITORS:				
PNC (Japan)	—	0.1	1.0	Centrifuge
UCOR (S. Africa)	—	0.25	0.25	Aerodynamics
Brazil	—	0.25	0.25	Nozzle
Australia	?	?	?	?
Subtotal	9.4	15.4	17.3	
U.S. Capacity	25.8	27.3	27.3	Diffusion
World Total	35.2	42.7	44.6	

Looking at the capacity of the existing competitors, EURODIF plant has installed capacity of 10.8 million SWU. They are operating at half that level, but that is the installed capacity of the facility. URENCO currently has about a million SWU's of capacity in operation.

We estimate by 1990 that will have expanded to at least two. Their philosophy is to build capacity as it gains contract commitments from customers so the number may be conservative or high depending on the future market success of their organization.

Techsnabexport, the most we have seen exported in a year, 3 million SWU's rather steady, estimated to be the full amount of surplus that they have available for sale. Potential competitors, there is an active program for development of centrifuge, deployment of centrifuge technology in Japan primarily for national reasons to service their own need in the future.

They have not announced any intention to enter into the market in competition with anyone else as of this date. We estimate that they will have probably about a million SWU's on line by 1990. That is optimistic, though.

Mr. LEE. Even so a million SWU's by 1990 would be less than the requirement of Japan?

Ms. PESKE. By far.

Mr. LONGENECKER. Their stated goal is by the year 2000 to have one-third of their needs met by indigenous capacity.

Ms. PESKE. U.C.O.R. in South Africa is being built primarily for indigenous fuel supply and employs an aerodynamic process, Brazil, has 250,000 SWU's, estimated to be expanding. Australia had been last year considering very intensely whether or not to construct an enrichment facility in Australia. They courted a number of the suppliers around the world for bids on which technology to use. It is our understanding that based on their valuation that they view the market as being unfavorable for deployment of enrichment capacity, we understand they are abandoning plans to construct a facility any time in the near future.

Mr. LEE. Is this integrated services connected with uranium resources?

Ms. PESKE. It was their objective to export their uranium in the highest form possible and that would be the enriched. If you look at the world total, U.S. capacity here is only the diffusion capacity. We have 27.3 million SWU's of capacity installed.

This number could grow as we construct GCEP or AVLIS or whatever.

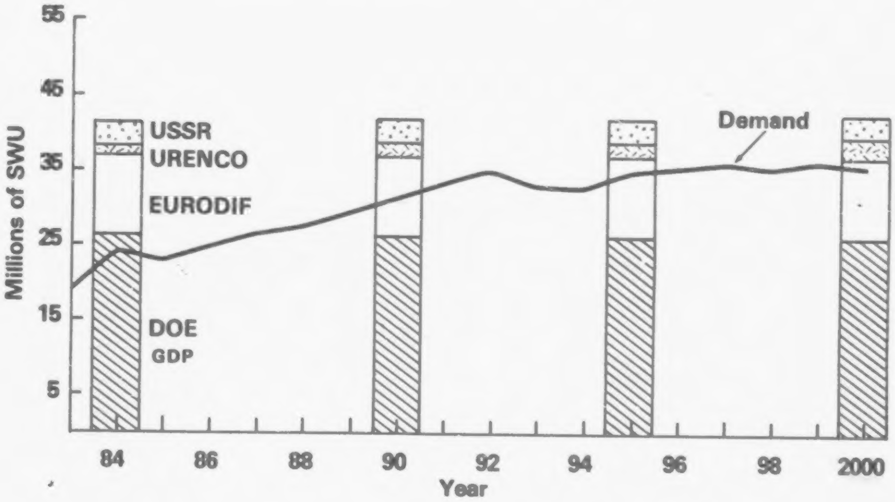
Dr. WHITTENBURY. Can you say anything about EURODIF's plan?

Ms. PESKE. EURODIF has under development advanced technologies including chemical process; ion exchange it is called and also advanced technologies including another laser technique and a plasma techniques so they do have a very active program for advanced technology and will expand this using another technology if they perceive a good market opportunity for that in the future.

Mr. MEAD. Is the 10.8 based on diffusion?

Ms. PESKE. Correct.

World SWU Demand & Capacity

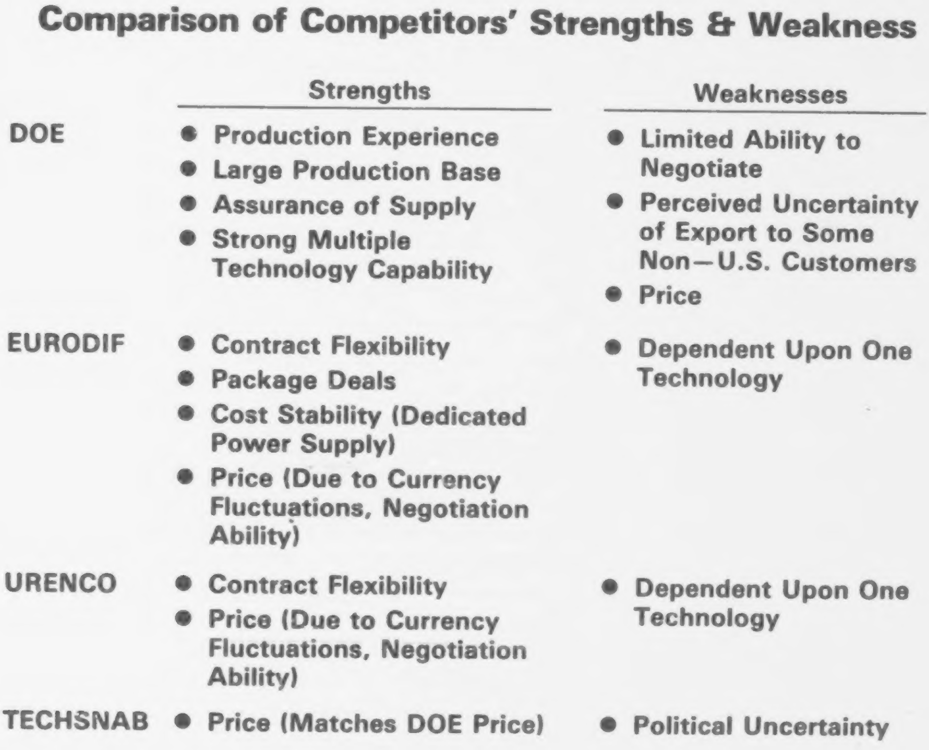


Briefly, I think John pointed out what the rough numbers are on supply versus demand. Here are the capacity figures that were shown on the last chart. This is estimated consumption. This is for free world and you can see that even if the United States does not build anything more than gaseous diffusion, there is still a surplus of installed capacity projected over consumption through the year 2000.

Dr. **Bohn**. And when you add military requirements that does not change significantly?

Mr. **Longenecker**. You can see the military requirements, the only ones that we know of are United States and they are shown in the interim work scenario. They do vary between 2 and 5 million SWU's a year to us. Those are projections but they are shown in the interim working scenario, so it is a significant portion of our base load over the next 10 years.

Ms. **Peske**. There are a lot of ways to meet that need that would still result in a general surplus of capacity available in the commercial sector.



Comparison of Competitors' Strengths & Weakness

	Strengths	Weaknesses
DOE	• Production Experience • Large Production Base • Assurance of Supply • Strong Multiple Technology Capability	• Limited Ability to Negotiate • Perceived Uncertainty of Export to Some Non—U.S. Customers • Price
EURODIF	• Contract Flexibility • Package Deals • Cost Stability (Dedicated Power Supply) • Price (Due to Currency Fluctuations, Negotiation Ability)	• Dependent Upon One Technology
URENCO	• Contract Flexibility • Price (Due to Currency Fluctuations, Negotiation Ability)	• Dependent Upon One Technology
TECHSNAB	• Price (Matches DOE Price)	• Political Uncertainty

Comparing the competitors' strengths and weaknesses, we have taken a shot at, we think, maybe a fair way to assess that knowing that we are unbiased. The Department of Energy strengths are clearly its production experience.

We have produced more separative work than any other supplier in the world. We have a very large production base which gives us a great deal of flexibility to respond to changes in the market. Our assurance of supply is not questioned as far as our ability to get the material to the customer on time. We have a strong multiple technology capability that you will be hearing about, so we have potential for maintaining technology leadership and the facilities associated with that.

Our weaknesses, we have a limited ability to negotiate compared to what a private company and these other suppliers act very much as private companies. There is a considerable amount of perceived uncertainty of our willingness to export to certain non-U.S. countries. They know they can get it on the dock, but the question is can they get it out of the country.

Dr. **Whittenbury**. Can you give us the worst example of matters on that?

Ms. **Peske**. Probably the South African situation, I would say, would be the worst example. We have also had situations with India. We have at times actually interrupted supplies to Europe. We have delayed supplies to Switzerland, who has great difficulty understanding why that happens. We have had delays to countries like Sweden.

It is a real problem for us in the political environment of nonproliferation.

Mr. **Mead**. These delays are all imposed on DOE?

Ms. **Peske**. We have the material, but delays are due to the export license system which is not our area of responsibility. Our weakness at present has been price. Our price is too high. However, we are the price leader in the world and everyone's price is generally pegged or referenced or compared to ours.

So, even though our price is high now, we continue to have a price-leadership position. EURODIF has a number of strengths, including their contracting flexibility. They are very responsive to sitting down and writing any kind of contract a customer would like to have within reasonable guidelines. They offer package deals all the way from the front of the fuel cycle to the back.

They offer financing in many cases along with that package deal. They have a great deal of cost stability because they build dedicated nuclear power stations to supply their gaseous diffusion plant and their power is cheap and reliable and they can use the French grid to get rid of their surplus power when the diffusion plants are not operating at full speed and don't have to get into the kinds of penalties that our contracts require.

EURODIF's price at present is very favorable due both to the currency situation and their willingness to negotiate price or peg price to DOE or whatever it takes to get the contract.

Their weaknesses are they are dependent upon one technology. They are perceived as having a tremendous amount of future potential, but they have some R&D underway and their history shows that once they decide to construct something they get in and do it pretty fast.

There is concern potentially in the U.S. mind of do we want to do business overseas or would we rather do business with an American firm.

Mr. **Barker**. A question: Is not another strength that they have that they are not necessarily on a cost recovery basis?

Ms. **Peske**. Yes, they definitely have—in their flexibility and in their pricing—act like a commercial firm. They can subsidize, do whatever they want to do.

Mr. **Mead**. They act like a commercial firm with a Government subsidy.

Ms. **Peske**. That is correct.

Dr. **Whittenbury**. Can you give a division between how the price is favorable from subsidy versus just plain good business?

Ms. **Peske**. That is very hard to do.

There has been some work done to look at, for example, what kind of assistance did they get in the construction of their plant. They got very, very favorable financing from their Government.

They did have some capital participation on the part of their Government. Whether that is being recovered or not is a little bit hard to know.

But the favorableness of that, the financing arrangement. What else they are doing is very difficult. They don't reveal all their financial information to the public as does DOE.

So, it is kind of hard to know exactly the extent of it.

Mr. **Longenecker**. To give you an example, it is our understanding—and again, they don't open their books to us—it is our understanding that the French Government supports the research and development.

So, that is not charged in the rate base.

Mr. **Brewer**. It is my understanding that COGGMA, which is the creature of EURODIF, or vice versa, pays a royalty to CEA, which is the equivalent—is it research and development arm—a very modest one.

Dr. **Whittenbury**. And the other thing—electricity is the key cost in diffusion. The "subsidy" might have been financing of the nuclear power plant.

Ms. **Peske**. And the interconnection to EDF, so they can switch loads back and forth. It is a very smart arrangement.

Dr. **Whittenbury**. We are going to talk about problems we have with power?

Mr. **Longenecker**. Yes, sir. This afternoon.

Ms. **Peske**. URENCO is a very similar situation to EURODIF, although they are a smaller supplier. They are very aggressive in the market with the same types of strengths that EURODIF has.

Techsnabeport has an opportunity to offer a pricing advantage because they will peg their price generally to match or be a discount from DOE.

However, they have some problems in that a lot of the western utilities are not quite eager to do business with the Soviet bloc, if they can do it in the West. Although there have been a large number of customers that have been very satisfied with the service that they have received from the Soviet Union.

DOE's Largest Customers

Customer	% of Sales
Tokyo Electric	7.0
Commonwealth Edison	6.4
TVA	5.2
Kansai Electric	4.2
Duke Power	3.7
Korea Electric Power	3.4
Swedish State Power Board	3.1
Chubu Electric	2.8
Southern Services	2.7
Middle South	2.7

Looking at the customers. These are the top 10 customers of the Department of Energy. Five of the top ten, including the largest, are non-United States.

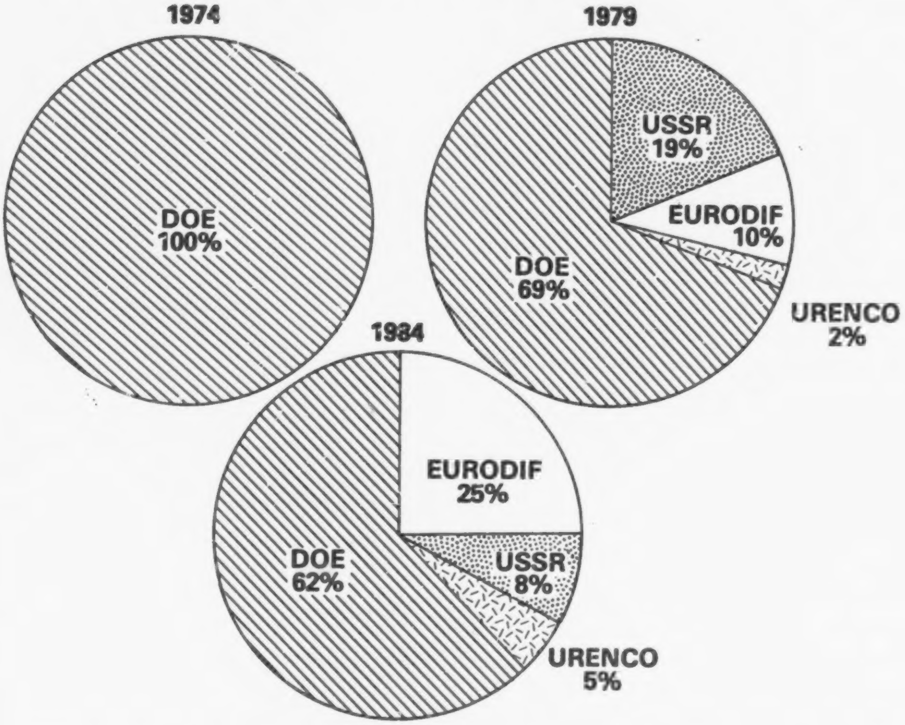
Tokyo Electric is the largest customer of the Department, with about 7 percent of our sales, followed by Commonwealth Edison, the TVA, and so forth on down the line.

So the largest market is the United States, followed by the Far East, followed by Europe. And the primary market in Europe is Sweden.

Mr. Longenecker. If I can interject—you notice out of 90 customers, the top 10 comprise nearly 40 percent of our total deliveries.

Ms. Peske. To look at the DOE share of the world market, we have gone from 100 percent roughly in 1974 down to about 69 percent in 1979, and currently at approximately 62 percent of the world.

DOE Share of the World Market



EURODIF's share has increased from 10 to 25. The Soviet Union's share is shrinking as the contracts they had signed during the mid seventies are beginning to expire and customers are going to a Western supplier instead of following on with the Soviet Union.

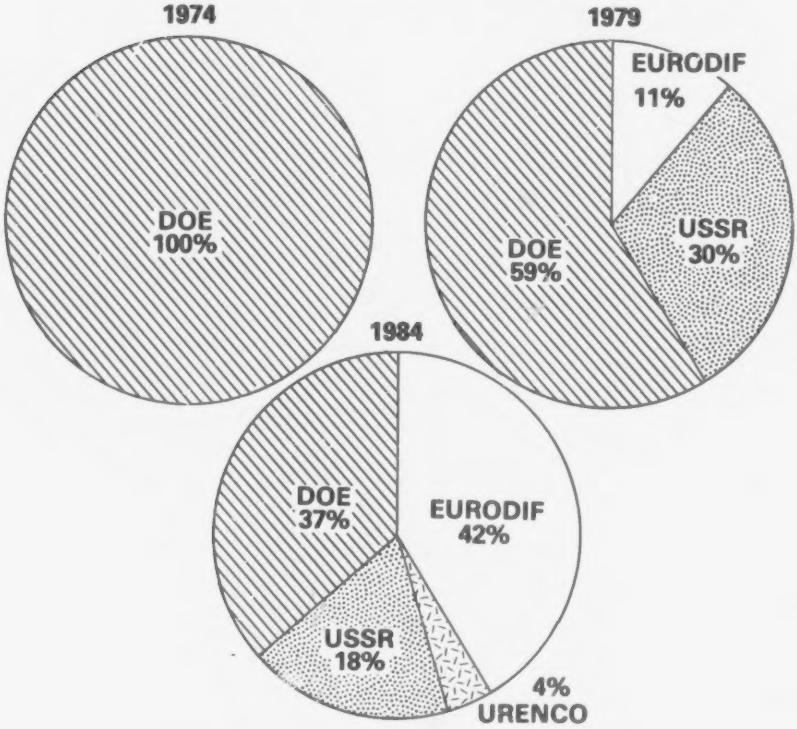
And URENCO's cost share has increased slightly over the period.

Mr. MEAD. That is not because the Soviet Union cannot supply.

Ms. PESKE. That is correct.

Mr. MEAD. It is their customers' choice.

DOE Share of the Non-U.S. Market



Contracting

Sherry E. Peske

Director, Office of Marketing &
Business Operations

August 16 & 17, 1984

Chronology of DOE Contracting

• 1969-72	U.S. Monopoly; Requirements Contracts Maintain Balance Between Supply/Demand
• 1973	AEC Established Long-Term Fixed Commitment (LTFC) Contracting Approach — Lack of Flexibility Created Oversupply of SWU's as Reactors Slip
• 1975	ERDA "Open Season" Temporarily Relieved Supply/Demand Imbalance, But Large Inventories Already Existed & Utilities Continued to Overcommit
• 1974-78	U.S. Order Books Closed; Competitors Filled Gap With Take-Or-Pay Contracts; Supply/Demand Imbalance Grew as Reactors Slipped Worldwide & Load Growth Dropped

Ms. Peske. That is right. Now, the major drop in that has occurred in the non-U.S. market. You can see that.

We have gone from 100 to 59 and are currently now at only 37 percent of the world non-U.S. market. And the large decrease there has been primarily in Europe and also some in the Far East.

To look at contracting for just 1 minute, there is a good part of this covered already, so I think I can move quickly through this history. There are a couple of key points to put in the back of your mind.

We began enriching in 1969 in a monopoly position. We used a requirements contract. You have heard that.

What a requirements contract was, was a very favorable contract to encourage the growth of nuclear power in the United States and abroad.

It favors the customer. The Government takes a fair amount of risk. The customer orders what he needs on 6 months' notice. He orders 180 days in advance. He is protected from large price increases by incorporation of price ceiling.

And he was given very lenient termination provisions One group of those contracts, the contract can be terminated for free in with 3½ years' notice.

Another through 5 years' notice, for a free termination. And the charges even between the notice periods, in other words, less than 3 years or less than 5 years, were rather modest.

In 1973, we changed contracting forms, stopped offering requirements, started offering long-term fixed commitment contracts. And we did that primarily because we were expanding capacity through the cascade improvement and the cascade upgrading programs.

We were installing additional diffusion capacity, and we wanted a very strong hard basis for demand upon which to base that very large investment.

So we created a very inflexible contract, take or pay for ten years. That lack of flexibility started to create an oversupply because people signed the contracts and then the reactors began to slip, when the contract forced them to take fuel anyway.

In 1975 we had what we call an Open Season to permit people to make those adjustments and get their contracts back in line with their actual needs. Almost everyone took advantage of that and about a year later we were right back in the same boat, because the reactor kept slipping and the contract was still rigid.

The key thing during this period was the closure of the U.S order books. They were closed from 1974 to 1978 while the United States debated whether additional capacity was going to be built in the Government or built in the private sector.

There was a legislative proposal known as the Nuclear Fuel Assurance Act, debated for several years during that period. This act would have permitted private companies to construct capacity in the United States with some Government guarantees.

And after fairly long debate, that legislation was not enacted. Finally, in 1978 we decided to build the capacity ourselves, and got the authorization to do that, and re-opened the order books.

While the order books were closed, of course, the competition was beginning to build its capacity, and it benefited quite substantially as a result of the United States not being able to take additional orders.

Chronology of DOE Contracting (Cont'd)

- **1978-81** **U.S. Re-Entered Market With Adjustable Fixed-Commitment Contract, Providing Limited Ability to Adjust SWU Deliveries For DOE Customers; Secondary Market Emerges as Method to Dispose of Excess SWU's; DOE Realized Sales Loss to Diversification; World Capacity Seriously Exceeded Demand**
- **1981** **DOE Lost Pricing Advantage; Strengthening of U.S. Dollar Favored Competition; Budget Constraints Tightened**
- **1982-83** **Price Emerged as Primary Buying Factor; Non-U.S. Utilities Entered Secondary Market, Stimulating Fierce Price Competition**

  DOE Experienced Large Sales Losses in Requirements Contracts

We reentered the market in 1978 with the adjustable fixed commitment contract, which was kind of half way between requirements and long-term fixed commitment.

And we provided limited ability for the customers to adjust their SWU deliveries. There was still quite a bit of overage. The main method that the customer had to get rid of his inventories was through the secondary market.

In other words, he had to take it from us and had to try to resell it to somebody else. And the AFC contract basically set that market up, and gave it a good boost during this time frame.

At the same time we began to realize some sales losses abroad, primarily through diversification, and world capacity was completed at EURODIF, and started again to reach levels at URENCO that was stable, and the whole place was well overbuilt.

During 1981, we lost our pricing advantage, as was pointed out—strengthening of the dollar favored our competition. Our budget started to get tighter. And we started to have more and more trouble trying to maintain a good program, when the technologies were requiring a lot of money and the revenue base was starting to shrink.

In 1982 to 1983, there was very fierce price competition. People started looking at the requirements contracts. Even though they were never written with that in mind, they saw the short termination provisions and very small termination penalties.

And prices dropped below the level that was required to make terminating these contracts and paying a penalty attractive. So the break-even price on the market was available.

So they terminated and paid penalties to take advantage of it. And we started to see significant losses in our sales.

Now, how much have we lost?

Sales Losses

- **DOE has Experienced Significant Losses in Enrichment Sales**
  - **20 Contracts Terminated Since 1979 (Value >$5 B)**
  - **Partial Terminations Exceeded $2.0 B**
  - **Penetration of Non-U.S. Material into Domestic Market Began with Potential of Massive Future Sales Loss**
- **Sales/Revenue Losses Occurred during Period of Major Capital Expansion by DOE, Resulting in Untenable Financial Condition & Jeopardizing Ability to Deploy much Needed Low Cost Production Capability**

We have lost 20 contracts in total since 1979, with a revenue value of more than $5 billion, and we have lost over $2 billion in partial terminations of the requirements contracts.

That is total to date.

Mr. POTTER. The $5 billion is not a per year.

Ms. PESKE. No. And as I mentioned, these losses were occurring during time of major capital expansion.

Mr. MEAD. Is that $2 billion added to the $5 billion?

Ms. PESKE. Yes.

Mr. BREWER. That is for the 30 year life of the contract—the $5 billion.

Ms. PESKE. Yes. It is for the life of the future revenue stream.

Sales Loss From DOE Contract Terminations in Whole

Country	Reactor	Lost Sales ($ M)	Replacement Supplier	DOE Contract in Force Until:
• Contracts Terminated:				
W. Germany	Biblis	$ 230	URENCO	
W. Germany	Philippsburg-2	200	URENCO	
W. Germany	Wuergassen	110	URENCO	
Spain	Valdecaballeros	430	EURODIF/TECHSNAB	
Spain	Lemoniz-1	280	EURODIF/TECHSNAB	1992
Spain	Lemoniz-2	290	EURODIF/TECHSNAB	1992
Spain	ASCO-1	280	EURODIF/TECHSNAB	1992
Spain	ASCO-2	420	EURODIF/TECHSNAB	1992
Spain	Almaraz-1	260	EURODIF/TECHSNAB	1992
Spain	Almaraz-2	280	EURODIF/TECHSNAB	1992
Spain	Cofrentes-1	260	EURODIF/TECHSNAB	1992
Spain	Zorita-1	70	EURODIF/TECHSNAB	1992
Spain	Garona	130	EURODIF/TECHSNAB	1992
Sweden	OKG-3	420	TECHSNAB	
Sweden	Forsmarck-3	255	Undecided	1993
Switzerland	Beznau-2	55	URENCO	
Switzerland	Leibstadt	300	Undecided	1989
Switzerland	Goesgen	350	Undecided	1991
U.S./P.S. of New Hampshire	Seabrook-1	290	Undecided	1993
U.S./P.S. of New Hampshire	Seabrook-2	305	Undecided	1993
	Subtotal	$5,215		
• Loss of New Sales:				
S. Korea	Units 9 & 10	200	EURODIF	
Taiwan	Units 7 & 8	300	EURODIF	
	Total Lost Sales	$ 5.7 Billion		

3/7/84

Now, take a look at them briefly. You see almost all of them are in Europe. West Germany terminating to replace the supply with URENCO, Spain terminating to replace its supply with both EURODIF and it has some contracts with the Soviet Union.

Switzerland right now, one of them is going to URENCO, some of them are undecided. We have actually had two terminations in the United States, Public Service of New Hampshire for the Seabrook units, and replacements is undecided primarily because of uncertainty regarding the reactor.

In addition, we have lost sales opportunities for new orders, in South Korea and Taiwan, both to EURODIF.

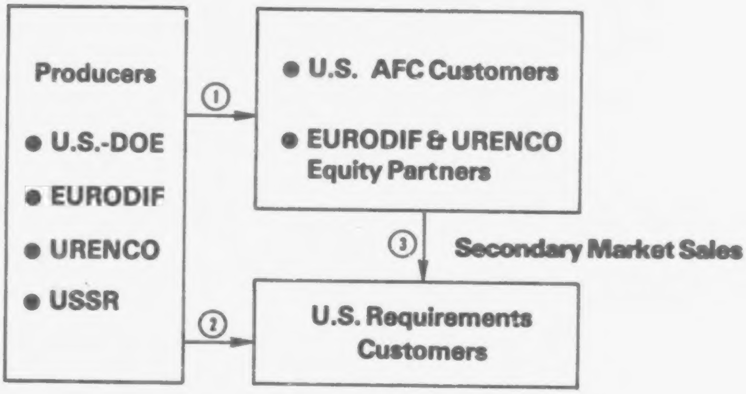
Mr. LEE. You haven't indicated any secondary market as a replacement supplier, but there are some on that list, are there not?

Ms. PESKE. For the secondary market, yes.

The primary-secondary market replacement material has been to date DOE origin. But there has been a lot of non-U.S. origin material beginning to move both into the United States and a lot of it abroad.

I will get into that in just a second.

Secondary Market Sales



Mr. Lee. All right.

Ms. Peske. This is, as Shelby pointed out, how the secondary market works. Producers force contracts either onto equity contracts or other customers in a fixed commitment way in excess of their need. They take it and sell it through the secondary market.

When you look over the whole world the only contracts you can penetrate in real time are the requirements contracts, and that is where it went.

There is about 16 million SWU's worth of material moved through this circuit in the last several years. It is about $2.4 billion worth of lost sales to the Department of Energy.

Now, the big ones in that market have been U.S. utilities, with about 12 of the 16 million SWU's. Facing that situation, we needed to construct a new type of contract.

Objectives of the New Contract

- Stabilize DOE's Market Share
- Reduce Potential for Future Buildup of Excess Inventories
- Increase Competitiveness of DOE Contract Features

Obviously, neither the requirements nor the fixed commitment contracts were working. So we set up the following objectives, in writing the utility services contract, we need to stabilize the market. We need to do that by reassessing and rebalancing this risk between the customer and the supplier.

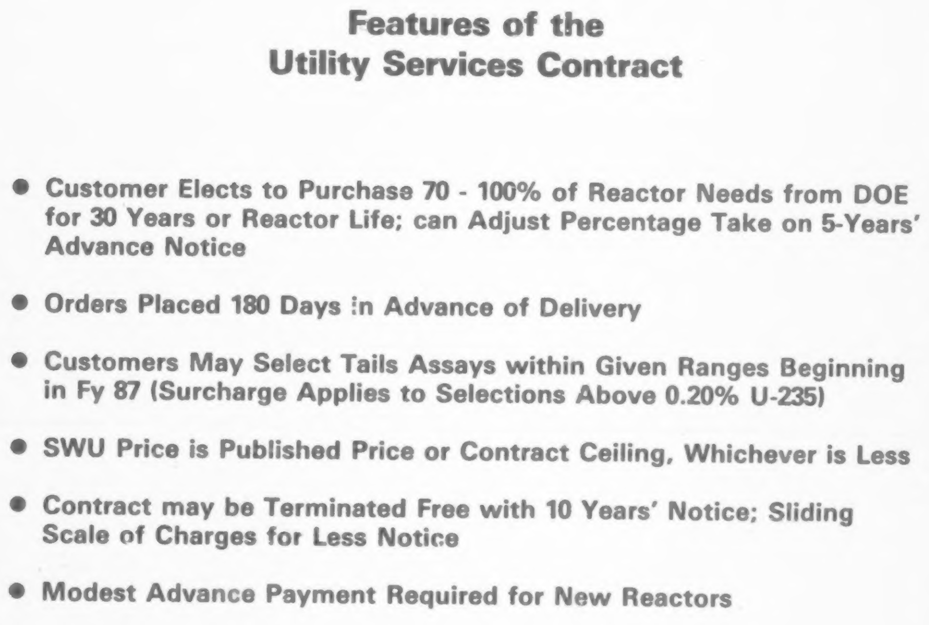
The customer needs to make a commitment of some stability to the supplier, so that the supplier is not being ratcheted up and down with very large capital intensive facilities, and the customer needs a lot of flexibility within that umbrella in order to make sure that he doesn't get himself out of sync between his fuel deliveries and his fuel needs.

So we want to have an orderly way to work off these inventories, we want to make sure that the inventories don't build up again in the future. We want to have a predictable and realistic demand base behind the operation.

And then we can reduce our costs and pass it on as a benefit to the customer in terms of reduced prices.

We also need to increase the competitiveness of the terms. We were using the AFC contracts and they were just not good enough compared to what else was being offered in the market.

I think it was asked earlier what do we obligate ourselves to do and what does the customer agree to with the new contract.



Features of the Utility Services Contract

- **Customer Elects to Purchase 70 - 100% of Reactor Needs from DOE for 30 Years or Reactor Life; can Adjust Percentage Take on 5-Years' Advance Notice**
- **Orders Placed 180 Days in Advance of Delivery**
- **Customers May Select Tails Assays within Given Ranges Beginning in Fy 87 (Surcharge Applies to Selections Above 0.20% U-235)**
- **SWU Price is Published Price or Contract Ceiling, Whichever is Less**
- **Contract may be Terminated Free with 10 Years' Notice; Sliding Scale of Charges for Less Notice**
- **Modest Advance Payment Required for New Reactors**

The customer elects to purchase between 70 and 100 percent of his reactor needs from DOE for 30 years or the life of the reactor. He can adjust this percentage within the range, within that 30 percent, on 5 years advance notice to DOE.

He can go up or down within that range on 5 years notice. DOE agrees it will supply all of those needs within that firm commitment that he has selected.

Mr. MEAD. Of the ones you just renegotiated, are they at the high end of that band or low end of that band?

Ms. PESKE. Well, there are some of both, obviously. What we have signed so far, we have signed eight of them. Out of the eight, six have been for 100 percent, two have been for 70 percent.

Now, there is a lot below that level. There is a very large base of customers. We have so far been quite encouraged by people tending somewhat towards the high end.

Orders are placed 180 days in advance. Very short lead time.

Customers may select tails assays within a given range. Don Gestson alluded to that.

The fact that they can, therefore, optimize a little bit better their fuel economics. There is a surchage to selections above two-tenths tails.

The SWU price is the published price or the contract ceiling price, whichever is less. The contract contains a ceiling formula. The beginning charge is $138 per SWU.

That charge can escallate only by experience of the department in its electric energy escalation—in other words, we can pass on what our experience is in power. And the balance of the charge will escalate only by the implicit price deflator of the U.S. economy for the GNP deflator.

Mr. LEE. Specifically, the GNP deflator, not the CPI.

Ms. PESKE. Correct. The contract may be terminated free with ten or more years notice. And for less than 10 years notice there is a sliding scale of charges contained in the contract. That is to give DOE a reasonably firm 10 year projection of sales, instead of the 3½ or 5 year kind of window.

There is a modest payment required for new reactors.

Utility Services Contract Cont'd

Conversion Terms

- Timing
  - Must Convert Before October 1, 1984
  - New Contract Terms Applicable with FY 1984 Delivery
- Incentives to Convert
  - Requirements Customers
    1. Lower price Starting in Fy 1984; ie., $135/SWU
    2. Ability to Vary DOE Commitment
    3. Flexibility to Optimize Product Cost by Selection of Variable Tails Assay Options
  - AFC Customers
    1. Flexibility to Optimize Product Cost by Selection of Variable Tails Assay Options
    2. Ability to Reduce Excess Contract Commitments
    3. Enhanced Schedule Flexibility; Requirements-Based Commitments
    4. Price Ceiling Protection

In terms of the conversion of the existing contracts to it, our current sales base, about 40 percent requirements contracts and about

60 percent fixed commitment contracts. Those customers electing to convert must do so by October 1. And the new contract becomes applicable right away with the FY 1984 delivery as they come in and commit under either a letter of intent or a signed contract to convert.

With regard to incentives to convert, it is kind of hard to get a requirements contract holder, especially one that has a 3½-year contract, to give it up. The incentives for him to do so are that he gets a lower price, that is, $135, that compares to what would be $157 under his old contract.

He has the ability to vary the DOE commitment, within that 30-percent range, so he still has some diversification opportunities. And he has the flexibility to optimize product costs by varying tails.

The requirements contracts do not contain variable tails. The AFC customers incentive is that they also get variable tails, they get the ability to reduce excess contract commitments during the conversion period within limits.

They get enhanced scheduling flexibility—the AFC contract made them firm up 5 years in advance, now they are only at 6 months in advance.

So there is a great deal of incentive there. It is a requirements based contract, not a fixed commitment based contract. And they also now will receive price ceiling protection which they had never had in the past.

Dr. WHITTENBURY. Do they have any way of wriggling out of their commitments, reading between the lines anywhere, other than simply—between 70 and 100 percent?

Ms. PESKE. It is always after you have a contract out on the street, you find there are a lot of people that find ways to read between lines. We don't know yet of any major ones. We tried to make that contract quite explicit so that the rules are quite well known, and that there is enough opportunity to do business up front with the flexibility the contract provides.

We think it is a pretty stable contract in that regard.

I would like to talk just a minute about how we price.

Pricing

Sherry E. Peske

Director, Office of Marketing & Business Operations

August 16 & 17, 1984

SWU Price: Legislative Requirements

- **Costs Will Be Recovered Over a Reasonable Period of Time (Atomic Energy Act)**
- **Uranium Enrichment Services Criteria Identifies Cost Components to Be Included**
  - **Power and Other Operating**
  - **Process Development**
  - **Depreciation of Plant and Equipment**
  - **Imputed Interest on Gov't Investment**
- **Any Change in the Criteria Must Be Submitted to Congress for a 45-Day Period**

The legislation requires us to recover costs over a reasonable period of time. Subsequent to the law, there is criteria which are established and which have been in existence for many years which outline in a little bit more detail what kinds of costs you must include in cost recovery.

Presently that criteria lists power and other operating, process development, appropriate depreciation of plant and capital equipment as well as imputed interest as costs that must be recovered over a reasonable period of time.

Any change in the criteria must be submitted to the Congress for a 45-day period. If there is no action taken during that time, the criteria go into effect.

Dr. BOHN. If I understand those terms, you could defer or capitalize some of the R&D costs.

Ms. PESKE. That is right. It doesn't say whether you should expense them or capitalize them or what. It just says "recover".

Mr. LEE. But to date you have not deferred those costs.

Ms. PESKE. That is correct. To date we have been expensing those costs.

DOE Enrichment Pricing History

1969 — Commercial Sales Begin; Legislation Stated That Price Should Provide Reasonable Compensation to the Government

1970 — Legislation Revised to Base Price on Cost Recovery Over a Reasonable Period of Time

1975 — Legislation Introduced to Price on a "Fair Value" Basis

1978 — Uranium Enrichment Services Criteria Revised to Include Imputed Interest on Uranium Inventories

In terms of the history, with that legislation and that criteria, it has been stable over time. In 1969, most of the data regarding gaseous diffusion technology as well as cost were still classified. There was not a lot of public information made available.

There was a pricing provision at that time which said that all you need to do is provide reasonable compensation to the Government.

Remember, they were trying to establish and foster the development of nuclear power. In 1970, that legislation was revised to say cost recovery. In 1975, there was a legislative attempt to change the pricing of what was called the fair value, which is something higher than cost recover, cost recovery maybe plus a profit or a return on investment.

That never passed.

Mr. MEAD. Undefined.

Ms. PESKE. Well, there were several proposals made as to how one would do that. But the legislation did not pass.

Mr. BREWER. That would include taxes.

Ms. PESKE. Yes; as if you were a private supplier was the general concept there. In 1978, the criteria were revised to include imputed interest on uranium inventories. Until that time we had been imputing interest on separative work, but we also changed it to include the feed on the component beginning in 1978.

$$\text{Charge} = \frac{\text{Unrecovered Gov't Investment} + \text{10 Yrs. Power \& Other Operating, Depreciation, Imputed Interest,} + \text{Supplemental Feed Costs}}{\text{10 Yrs. of Sales} + \text{Ending Inventory}}$$

How do we do the price? There is a very simple algorithm for the charge. It is basically a 10-year period used. We project forward cost for 10 years, divide them by forward projected sales for 10 years, to arrive to unit charge.

We update the price every year and look out for the following 10-year period.

Cost on the top of the unrecovered Government investment to date, plus 10 years of projected power and other operating costs, including R&D, depreciation of completed plant and capital equipment, using the straight line method over 25 years or the serviceable life of the asset.

Imputed interest on inventories. And the Government investment in the enterprise. And supplemental feed costs. At times when the customer brings us the feed, we put more feed than what they brought us into the plant. We supplement it with some of our own feed because we have an economy as a result in the way we operate, and we wind up selling some feed to the customer when he takes his product.

That is called supplemental feed. That is divided then by 10 years of projected sales and the ending inventory.

Mr. MEAD. That is completed plant that you depreciate.

Ms. PESKE. We are projecting out 10 years. If during that 10-year period you are projecting startup, you have some depreciation. But most of it right now is imputed interest—interest during construction, which is expensed, not capitalized.

Mr. LEE. So you are charging interest during construction on facilities that are being built but not yet in service in current prices.

Ms. PESKE. Yes.

Mr. LEE. Mr. Ottinger's committee would refer to that as construction work in progress, would they not?

Ms. PESKE. Yes.

Mr. LEE. Thank you.

Ms. PESKE. I believe so.

Now, there is often some confusion between the Federal budget system and what the price is doing. Let me make a stab at trying to explain this mire of information.

Budget		Accounting/Price
Power Costs	=	Power Costs
GDP Operating Costs	=	GDP Operating Costs
R&D Costs	=	R&D Costs
GCEP Outlays	≠	GCEP Depreciation Costs
No Cost	≠	GDP Depreciation Costs
No Cost	≠	Imputed Interest
No Cost	≠	Inventories (Booked at Actual Historical Cost)

Budget Price

$$\frac{\text{Annual Budget Costs}}{\text{Annual Sales}} = X$$

Calculated Price

$$\frac{\text{10 Yrs. Forward Accounting Costs}}{\text{10 Yrs. Forward Sales}} = Y$$

We have the budget on this side. We do the budget every year, as you know. And it includes that year's power costs, operating costs, R&D costs, GCEP outlays. And you total all those up and subtract the estimated revenues, and you come down to the budget.

The budget only looks at 1 year, in the cost column. When it comes to revenues, though, revenues are obviously sales type price, and price is looked out for 10 years. So there is 1 year budget, doesn't necessarily match with price, because the price is done on a different basis. The price is 10 years, and it uses accounting costs, not necessarily budget costs.

It uses power costs, operating costs, R&D costs, just like the budget. But instead of putting in the capital outlays, it will have depreciation costs for GCEP, depreciation costs for GDP, imputed interest during construction, imputed interest on inventories.

And those interest and depreciation costs are nonbudget type costs. So what you would get is you could price by taking the annual budget, dividing by the annual sales, and that would be one value, x.

What we do is we use 10 years of accounting costs, 10 years of sales, and we get a value, y. Now, in the system what happens is you take these budget costs and you subtract from them revenues which are based on y, and that is where there is often alot of confusion, because there are really two different accounting treatments.

Mr. LONGENECKER. In other words, the costs for GCEP depreciation, GDP depreciation, imputed interest and inventories are used on an annual basis to fund new capacity construction, in this case GCEP.

Dr. WHITTENBURY. The bank doesn't get any money.

Mr. LONGENECKER. That is right. We are reinvesting it.

Mr. LEE. The forward depreciation for GCEP—for GCEP increments expected to come into service within the 10 year window and then they begin.

Ms. PESKE. That is correct. Up until that time they would be here in the imputed interest line.

Mr. LEE. In the calculated price in the lower right hand, your denominator is 10 years of forward sales. We do have an analysis from the GAO that was sent to us. Is it not so that they used as the denominator production rather than sales?

Ms. PESKE. Yes. If I recall the report correctly that you are referring to, they did have a table in there where they took, like the actual annual cost of what we were producing or paying in any 1 year, and divided it by that year's production.

Now, what happens when you do that is the unit cost looks very high, because one thing we are doing at present is selling out of inventory. The inventory SWU's were produced at lesser cost in the past when prices were a little bit lower for electricity and other things.

So by dividing by production as opposed to sales you do get a distortion that we don't think accurately describes what is going on.

Mr. LONGENECKER. If I could expand on that. I touched on that this morning. One of our assets is a preproduced inventory. At the end of the last fiscal year we had about 20 million SWU's in inventory.

One of the ways we are helping to keep the price down in near term is to use those, those are real assets. So you will notice in that scenario that you see, in each of the next 3 to 4 years our production is substantially below our sales, because we are delivering a large portion of the material out of the preproduced inventory.

Mr. MEAD. But at the present price.

Mr. LONGENECKER. That is correct. And it is valued in our system in that formula on the average cost, weighted average cost of production.

Dr. WHITTENBURY. Going back to the legislative requirements, who interprets how the cost will be recovered over a reasonable period of time? Because, obviously, a decision has been made not to recover interest or loaned money to date.

Ms. PESKE. We have recovered interest and loaned money to date. We do have interest in the charge.

Dr. WHITTENBURY. But it is being used elsewhere. The cash flow goes elsewhere.

Ms. PESKE. What happens to all of the cash that comes out as a result of the sales goes into then the budget system. It could easily go back into the Treasury and then get an appropriation.

They just stopped that loop.

Dr. WHITTENBURY. So R&D is really being paid for by the budget rather than being expensed.

Ms. PESKE. R&D is being expensed in the price as well as in the budget. These match one for one—although the price will take a longer period of time to get them all back, because it is using a 10 year period as opposed to just a 1 year budget period.

Mr. LONGENECKER. An alternative is, you are reinvesting those moneys you are drawing from imputed interest into new capacity R&D. Those become tangible assets of the enterprise.

At some point in time the revenues will exceed your cash outlays, and you will in essence return money to the Treasury and retire that debt.

Dr. **Whittenbury**. But at the present time a decision has been made to defer that for quite some time.

Mr. **Longenecker**. It has been made to reinvest for other purposes.

Dr. **Whittenbury**. Who made that decision?

Mr. **Longenecker**. That is a DOE recommendation that we make annually to Congress, and that they review and approve, in approving our annual budget.

Dr. **Whittenbury**. It is reasonably clear that is what they are deciding upon.

Ms. **Peske**. There is no legislative requirement for payments back to the Treasury. The act requires us to recover our costs. The act doesn't go on to say independent of the budget cycle, what you do with the revenue that you receive.

In the past, like the Atomic Energy Commission days, we had a budget for UE which was straight-out appropriation, and the revenues went along with a lot of other revenues from isotope sales and everything else, and that went into a big pot which the Atomic Energy Commission then netted out of its total budget request.

In 1978, it was decided to apply that directly to just the enrichment account. It could be done either way. But it is really, I think, the budget cycle that drives that decision, not some other piece of legislation.

Dr. **Whittenbury**. Would it be unfair to say that the legislative requirement is not very clear?

Ms. **Peske**. No, it would not be unfair to say that.

Mr. **Lee**. I want to make sure I have the same understanding.

Let me go ahead now. In your price you are collecting these depreciation costs and imputed interest, and that comes in as cash. But that cash is more than adequate to cover the GCEP outlays.

Ms. **Peske**. In the past it has been adequate to net out the whole budget including GCEP. We have had some awfully tight years the past few, but we have made it.

Mr. **Lee**. All right. I see your next chart you are going to address the $135.

$135/SWU Charge

(Millions of FY 85 Dollars)

FY	Power	Dif. & Cent. Oper.	Dep.	Interest	All Other Beg. Inv.	Split Tails	R&D	Misc.	Total Costs	Sales
85	1,013	264	76	553	1,536	116	150	-104	3,604	14.03
86	916	289	86	615		143	75	- 10	2,114	13.87
87	920	294	91	665		103	75	- 60	2,088	13.58
88	931	332	92	727		92	75	- 60	2,189	12.63
89	1,109	379	116	828		77	75	- 60	2,524	14.30
90	1,187	396	158	934		0	75	- 60	2,690	18.95
91	1,172	413	199	998		0	20	- 60	2,742	23.74
92	1,163	431	243	1,031		0	20	- 60	2,828	24.01
93	872	445	285	1,049		0	20	- 60	2,611	23.15
94	699	399	326	1,041		0	20	- 60	2,425	23.14
									E.I.	9.82
	9,982	3,642	1,672	8,441	1,536	531	605	-594	25,815	191.22

Charge Calculation:

- Base Price = $\frac{25,815}{191.22}$ = $135.00

Price Components:

Power	$ 52.20
Other Op.	19.05
Dep.	8.74
Interest	44.14
All Other	10.87
	$135.00

4/84

Ms. PESKE. Yes. How did we get the charge of $135. This is quite busy, but I think it illustrates quite clearly how it is done.

You see here the cost elements across the top—power, centrifuge, and diffusion operating costs. Here is your depreciation line. Now, what we use for depreciation is straightline depreciation over the service life of the facility, for GCEP that is estimated now at 25 years, for the GDP's we have quite good estimates on each of the components, so it is a bit longer than that.

There was a change in the method of depreciation made in coming up with this price. What is included in this is depreciation in the future on the portion of the gaseous diffusion plants that we expect to operate.

There is no depreciation in here of capacity that we estimate we won't use. So there is about $2 billion of undepreciated gaseous diffusion plant and equipment coming into this period.

Eight hundred million dollars or about 40 percent of it is what is included in this price, because we expect to only operate the diffusion plants at about 40 percent of their capacity. The other 60 percent is going to be written off.

Mr. MEAD. Just written off by the Government?

Ms. PESKE. It will not be recovered, but written off, taken as a loss, if you would call it that in the private-sector sense.

Mr. Mead. GAO made the point in here, you are actually utilizing a lot more than 40 percent of the plant to get 40 percent of the production.

Mr. Schmidt. That is not correct. What they failed to understand is we are using more than 40 percent of equipment, true, but we are not using it to its capacity, we are using our entire equipment contracts at 40 percent of its rated capacity.

It doesn't mean we are using only 4 out of 10 machines in the plant. We are using the complex at 40 percent of its rated capacity.

Dr. Bohn. Is there any advantage to doing that, instead of shutting one down? Is it more efficient if you run it at a low rate?

Ms. Peske. Right now I think the advantages are several. One, we have to pay for a lot more power than we are having to take. We are trying to keep all three plants operating at their minimum safe level until we can make a wise decision on which one to shut down.

That is dependent on some information yet to be had, like which technology are you going to replace it with, and what your market share is going to be.

We will actually shut a plant down as more information becomes available to be able to make that decision wisely.

Dr. Bohn. Are we going to go into this decision further later today?

Mr. Longenecker. Could we show you the rationale? If you would like to talk about either the accounting or the gaseous diffusion, the logic of the use of them, they are two different issues. In essence, efficiency of operation is probably, of a gaseous diffusion plant, does not increase with increase in power. There is an optimum at or about 50 percent in that range.

So operating in these ranges is not terribly power inefficient for us.

The projections that we have is that over the lifetime of those plants, they will not, because of increasing power costs and other reasons, continue to be an asset that has value in the marketplace of their useful life.

There is one other point to be made, and that is you recall that we took over these plants in 1969. At that point some of them were nearly 25 years old.

The historical book value, then, from 1940 to 1983 is on the order of $3.9 to $4 billion. When we took them over, the book value was around $2 billion that was assigned to them. We immediately, because of the condition of the plants and their amount of power that it took to generate a unit of work, began to upgrade them.

And in the 1970's invested $1.5 billion in cascade improvement and cascade upgrating program to bring them to the point of efficiency that they are today.

There are two arguments to be made. The accounting logic argument is that they have no value in the marketplace, and therefore we should not continue to depreciate an asset without value.

Another argument that can be made as to whether the evaluation of those plants, when we took them over in 1969, was, in fact, $2 billion to the enterprise, whether that was a real worth at that time, considering that we had to put $1.5 billion into them to improve and uprate them, we have returned depreciation to date of nearly $2 billion.

So if I could lead you through that calculation. Roughly $4 billion in historical book value, GDP's, we have returned about $2 billion which gives a remaining balance of $2 billion. And the $4 billion of the historical book value is again in round numbers, roughly $2 billion of their evaluation when we took them over in 1969, $1.5 billion that we have added for CIP–CUP, and approximately $500 million for other environmental and upgrade projects.

So of that we have returned $2 billion which is roughly equivalent to the amount we have invested in them. We assume that in the future, if we operate at 40 percent, and you understand if we operate at 50 we will depreciate on the basis of 50 percent of the plants, but if we operated at 40 percent we would return another $800 million of depreciation over their useful life, and the amount that we would assume would not be economically recoverable is $1.2 billion.

That is the amount that we have taken off our books. The effect of that is to lower our fiscal year 1985 price by $9 an SWU.

Mr. **Mead**. Total depreciation about 8 percent.

Mr. **Brewer**. To add to what John has just said, the question has been raised whether this is in accordance with the law that requires cost recovery. The criteria specifically allows for partial depreciation under the Conway formula.

Ms. **Peske**. There is precedent for that in the past, when unused capacity was not depreciated. The accounting theory is that the value of the asset is not a real value, it doesn't have any economic value, get it off your books, it is an artificial asset. Write if off.

And that is what we have done.

Mr. **Longenecker**. In addition to the accounting theory, I must stress the practical argument, were those plants worth $2 billion in 1969 is a question that has been raised with us. And I think it is an equally valid question as to the accounting theory that they are now no longer a useable asset.

Mr. **Lee**. Now, you were marching across that page and we were talking about depreciation. Next is interest.

Ms. **Peske**. Yes; now, you had a question I think on this repayment. What we do here is we—the theory is that the Government borrowed the investment money. Whether it did or not, you could not really trace it all the way back through Treasury and find out.

But the theory behind this is that they did. We are using an interest rate in this calculation of 10 percent. And this is interest on inventories and construction of the centrifuge project primarily.

Mr. **Lee**. Hold it. Interest on inventories of feed as well as—both, both inventories.

Ms. **Peske**. And interest on the gaseous—on the gas centrifuge plant construction.

Mr. **Lee**. Interest on GCEP construction.

Ms. **Peske**. Yes.

Mr. **Lee**. How about interest on the undepreciated balance, the gaseous diffusion plant?

Ms. **Peske**. Yes.

Mr. **Lee**. In this case would that be $800 million?

Ms. PESKE. Yes; what we would do—the calculation actually will see how much is outstanding over the period, uncharged interest on what isn't being recovered, until it is all recovered.

Mr. MEAD. Interest on the undepreciated plant.

Ms. PESKE. Right.

Mr. LEE. Walk me through one more time.

We are paying interest on the GCEP not yet in service.

Ms. PESKE. Yes; interest during construction. And it is being expensed.

Mr. LEE. And it is being expensed.

Mr. BREWER. And that gets in the rate base.

Ms. PESKE. And it is in the rate base.

Mr. LEE. Yes; you have not got a column there under the $135 that includes the actual construction expenditures for GCEP. Or is that under R&D?

Ms. PESKE. No; there is nothing there. The interest during construction is on GCEP, and then out in this time you start to see the depreciation of the GCEP capital.

But there is no cost element in addition. That would be double-charging.

Mr. BREWER. The customer is not paying for the construction of GCEP.

Mr. LEE. Interest only.

Mr. BREWER. Interest only.

Mr. MEAD. Construction—is that not under the R&D account?

Ms. PESKE. No.

Mr. LEE. You are really capitalizing in construction—bringing into service when it goes in. You are not capitalizing the interest on construction. You are charging for that as you go.

Ms. PESKE. That is right.

Mr. BREWER. In the earlier chart there was, type financing on the left and the pricing formulation on the right. The two or three book costs, that is, depreciation, and imputed interest, just about match the outlays on a cash flow basis for GCEP.

Mr. LEE. As of right now, how much have you invested in GCEP?

Mr. LONGENECKER. To the end of this year it will be approximately $2 billion.

Mr. LEE. $2 billion. And you have not started depreciating that.

Mr. LONGENECKER. That is right.

Mr. LEE. Interest on the $2 billion, plus interest on the $800 million written down value of the diffusion plant, because the interest on inventory——

Ms. PESKE. In calculating this depreciation line, you input the capital charges all the way out and you depreciate them as they begin to start up. So there is more than just the $2.3 billion we have already spent.

It is interest on everything we expect to spend on GCEP over the period.

Mr. MEAD. In the out years.

Ms. PESKE. Right.

Mr. LEE. Now——

EXHIBIT I
Uranium Enrichment Services Activity

BALANCE SHEET

	(Thousands of Dollars)	
	FY 1983	FY 1982
• Assets:		
Cash:		
Funds in U.S. Treasury	$ 833,429	$ 799,628
Cash with contractors	11,184	11,034
	844,613	810,662
Accounts receivable:		
Domestic trade	148,371	36,208
Foreign trade	157,339	114,020
	305,710	150,228
Inventories:		
Uranium		
Separative work	1,609,808	1,808,967
Feed material	640,451	829,957
	2,250,259	2,638,924
Production stores and process spare parts	48,275	47,875
	2,298,534	2,686,799
Plant:		
Completed plant and equipment	3,937,765	3,796,980
Less-Accumulated depreciation	1,878,250	1,793,661
	2,059,515	2,003,319
Construction work in progress	1,858,758	1,392,053
	3,918,273	3,395,372
Payments and deposits	6,232	4,871
Total Assets	$7,373,362	$7,047,932
• Liabilities and Government Investment:		
Accounts payable and accrued expenses	130,378	152,524
Deferred credits	269,264	397,001
Total liabilities	399,642	549,524
Government investment	6,973,720	6,498,407
Total Liabilities & Gov't Investment	$7,373,362	$7,047,932

Ms. PESKE. This might be a help to you. In your annual report there is a set of financial statements. On the balance sheet you will see the items upon which we impute the interest.

They are primarily inventories of uranium, including separative work and feed material. And also the construction work in progress, and the undepreciated balance on the portion of the plant that is completed.

Mr. **Lee**. Back to the inventory a moment.

Why is the inventory there? First of all, is that the entire inventory?

Ms. **Peske**. This is the beginning separative work inventory.

Mr. **Lee**. All of it?

Ms. **Peske**. All of the separative work. And then for feed it is all of the feed that we have in the separative work inventory, plus we have a working inventory.

Mr. **Lee**. So you are charging interest in the $135 on all of the inventory. You have not determined what inventory is reasonable for the civilian sector, nor have you allocated inventory to defense needs in this calculation.

Mr. **Schmidt**. We are charging interest in all the separative work inventory the Government interest has. We are charging interest on the uranium inventory only to the extent it is needed for operations.

We do not charge interest on the entire feed stock.

Mr. **Lee**. All the separative work inventory, interest on that is charged to the civilian sector.

Mr. **Schmidt**. On the denominator are both commercial and Government sales.

Ms. **Peske**. In this 191.22 billion SWU's that is estimated to be sold over the period, that includes Government use also. So the Government users are paying an allocated share of all of these costs in the pricing calculation.

Since they are in the denominator, they are paying an equal share of the numerator.

Mr. **Mead**. They are in both places.

Ms. **Peske**. Yes.

Mr. **Lee**. While we are on that subject—if you are enriching to 5 percent or less, you have a certain power cost. If you are enriching above 5 percent, to 98 percent, is your power cost linear?

Mr. **Longenecker**. No; it is not.

Ms. **Peske**. It will come up and start going down again.

Mr. **Lee**. Is the average power cost per SWU higher above 5 percent than below 5 percent?

Mr. **Longenecker**. Yes.

Mr. **Lee**. By how much?

Mr. **Longenecker**. I am not sure. We can treat that when we go through the gaseous diffusion presentation. We are going to explain how we operate the plant and the dedication of facilities.

If I could beg your indulgence, we will defer that.

Ms. **Peske**. There are other operating costs associated with the high enriched material. More safeguards, more inventory accountability, and all that kind of thing, above 5 percent, because it is now highly enriched uranium.

Mr. **Lee**. But all the operating costs are commingled.

Ms. **Peske**. That is right. We are going to be separating them in the future. But they are commingled in here.

Mr. **Lee**. They are commingled for determination of $135.

Ms. **Peske**. Yes. OK. That is the beginning inventory.

Here is the split tails feed sales that I referenced before. There is also a change in this accounting treatment this year.

We used to sell split tails at what was market value. The law requires us to recover reasonable compensation, whatever that means. In the past it has been at our cost, above our cost, below our cost, whatever we can get basically in a reasonable market condition.

This is priced at our acquisition cost as opposed to a market cost. That was a change made this year. It is now being sold here at our acquisition cost, which was about $9 a pound.

R&D costs are also in here expensed. Miscellaneous costs includes additional receipts that we receive from packaging, handling, miscellaneous services. And this number up here reflects the fact that cumulatively through 1983 we have recovered all of our costs plus about $37 million cum profit to date, as you can see in your financial statements.

That goes into this pricing calculation as a negative cost. That is kind of a good barometer as to where we stand on cost recovery.

To date it is about $37 million cumulative profit.

Total cost divided by total sales——

Mr. **Mead**. By this formula.

Ms. **Peske**. Yes; now, it is self-correcting in that sense, because we will do it all over again next year, and either the profit will go in as a negative cost, or if we have a loss, it will go in as an additional cost to be recovered—$135.

You can see the elements here. Power is the largest, followed by interest. Those are the two major pricing elements in this calculation.

Dr. **Bohn**. Two questions. Down on the bottom. I Understood the power cost was more like $70 per SWU, instead of $53. Is that because you expect it to fall in the future?

Ms. **Peske**. I am not sure what your $70 came from. This is expected to be all the power that we are going to purchase over the period. It is done in constant dollars.

So there is nothing there explaining that. We are going to sometimes operate higher or lower. The $70 figure may have been an annual—in any one year type figure. But for the 10-year period, that is the number.

Mr. **Mead**. Does that include the power you have to buy that you are not using?

Ms. **Peske**. If you look in the financial statements, you can see on an annual basis that number may be higher. It was $75 in 1983. This is a 10-year average.

Dr. **Bohn**. So you expect it to fall significantly in real terms?

Mr. **Longenecker**. No; what this says is that you expect that the amount of power—the value of the power required to produce a SWU in the 10-year period would fall. That doesn't reflect falling power costs.

This does reflect an anticipation of advanced technologies, which as you have heard have less than 5 percent power use for centrifuge.

Mr. **Mead**. This includes the mandatory power you have to buy that you are not using?

Ms. **Peske**. Yes; demand charges, capacity charges, is all in this line here.

Mr. BREWER. In 1984 the demand charge for power not used as $226 million.

Ms. PESKE. It is about a billion dollars.

Mr. MEAD. How much of that 9.9.

Ms. PESKE. About a billion dollars.

I am sorry. $2 billion.

Mr. MEAD. Twenty percent.

Ms. PESKE. Twenty percent.

Dr. BOHN. OK. The second point on that. If you were doing this on a year-by-year basis and just looking at variable costs, of the $135, how much is variable costs this year?

Mr. LONGENECKER. I am sorry.

Ms. PESKE. How much is variable cost this year of the $135? Very little. We could probably alter some of our production.

Mr. LONGENECKER. I think the difference is the production versus the R&D. Let's take fiscal 1985.

Out of the total budget there, $1.65 billion, $500 million of that is research and development, construction of new capacity. The remainder is literally the cost of operating the gaseous diffusion plant.

So $500 million of the $1.65 billion is in that nonproduction category.

Mr. LEE. That is then operating and power costs under budget calculations.

Dr. BOHN. And this year's power costs rather than average over the next 10 years.

Mr. LONGENECKER. That is right.

Mr. LEE. In that operating cost is depreciation.

Ms. PESKE. No.

Mr. LEE. No; that is not in there.

Mr. LONGENECKER. What we have done is just crossed back between our annual budget and our accounting. I just gave you a 1 year's outlay for fiscal 1985.

The numbers that you are looking at for the components of the $135 price are the 10-year average.

Mr. LEE. I am pursuing Roger's question a little bit. Some of the operating costs are fixed. Payroll.

Mr. LONGENECKER. That is correct.

Dr. BOHN. Basically, we are just talking about the variable power costs for a one SWU change, which would be $75.

Ms. PESKE. Basically, we are talking about the energy costs.

Dr. BOHN. Which would be what, $50?

Ms. PESKE. You pay for demand for power you don't take, and then for the power you do take you pay a demand and an energy portion. If you can take less power, that demand and energy portion associated with that increment.

That is by far—if you want to cut back, whatever, on your R&D accounts, those are kind of discretionary. It is very hard to move those substantially in just 1 year.

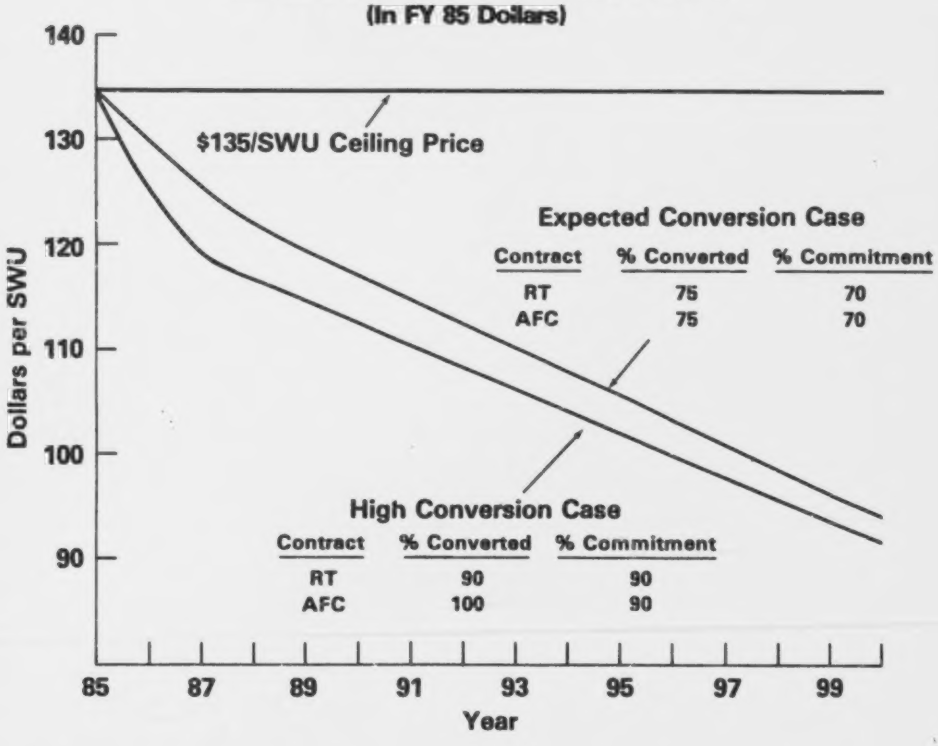
Mr. LONGENECKER. I apologize again for asking to defer a subject. The issue you are getting into also crosses into the marginal cost of production from the plants.

And they are different in each of the three, because we have three different power suppliers at three different rates. Under the gaseous diffusion presentation, we will get into that and try to explain how we balance those to optimize the average production cost, but then address the question, if we want to produce an additional increment, where would be the cheapest place.

Ms. PESKE. That pricing projection, it is assumed that we will construct $4 buildings of gas centrifuge using advanced gas centrifuge plant machines. Not two, but four.

Now, if we choose to construct AVLIS instead of centrifuge, then the composition of those costs would be different. We chose the centrifuge one because generally speaking it is higher capital intensity, more expensive during the period, and we were being conservative in using the higher cost case as opposed to the lower cost case.

US Enrichment Contract Prices
(In FY 85 Dollars)



The last display is to show where we expect future prices in constant fiscal year 1985 dollars to stand relative to the $135 ceiling.

Now, as you can see, the prices can be varied some by varying the costs. But it also varies depending upon whatever the sales base is.

Changes in the sales base can make a significant difference in the price. We projected here a price using the same type of program for building GCEP and using gaseous diffusion as needed to meet demand, and we have expected here 75 percent of the customers to convert and take 70 percent of their needs from DOE.

So it is kind of the low end of the conversion range. And if that happens then you have a pricing profile over time like this.

We also tested for a higher conversion case, 90 percent of the requirements customers converting, taking 90 percent of their needs on the average, and the AFC, a 100 percent and 90.

You can see then that the price will come down some as a result, driven primarily—the fact that the curve is going down is because of new technology.

How fast it goes down is a function of demand.

Mr. LEE. We are going to thank you for this—and have the opportunity to return to questions with you in this area later today.

However, let's hold questions on this question for now. We thank you, Mr. Secretary, for coming.

Will you be here this afternoon?

Mr. BREWER. Yes, sir.

Mr. LEE. Very good. Our agenda calls for presentations on the current international market from SWU broker perspectives. We were supposed to do that before lunch.

I suggest that we proceed with that now in order to hear what these folks have to say.

And then we will return to the DOE planning process and other questions in this area immediatley following lunch.

Mr. Bob Wolcott—and is Mr. Wolf here?

STATEMENT OF T. ROBERT WOLCOTT, CHAIRMAN AND CHIEF EXECUTIVE OFFICER, NUEXCO

Mr. WOLCOTT. My name is Bob Wolcott, and I am chairman and chief executive officer of NUEXCO. NUEXCO is a consulting brokerage and information services company. Approximately two-thirds of our business is international business.

From a business point of view, we have two primary interests in DOE activities, and the first is the impact upon brokerages and the second relates to client advice, and that is concerned of course, too, with the impact of DOE policies upon those clients.

My personal experience with nuclear fuel is largely, though, not wholly market-related. We very much appreciate the opportunity to present thoughts to this select group, and I will endeavor to be as candid as possible.

Some of the views that I express, of course, will reflect some of my own management philosophies. The main theme I would like to promote today is a need for clarification of the DOE role as it affects United States and foreign supply.

I do not believe that there is a universally-accepted view of what that role is or should be. Congress, DOE, U.S. utilities and foreign utilities all have a stake in a better understanding.

The main thrust of U.S. enrichment services appears to center on improving market share, holding production at a high level, combatting nationalism and competition and price reductions and advancing technology as a means of solving problems.

Underlying this seems to be the axiom that a good offense is a good defense. It is not clear to me that there is a good connection with the means being employed and what ought to be the position of DOE.

It is to this concern I would like to address my comments today. There are three basic alternative missions DOE could pursue. One is as a businesss in which case, cash flow, profitability and return on investment must be controlling measurements.

Gaining political ends for the U.S. Government would not dictate in this case. Another area is that of serving as a political instrument for the U.S. Government.

In that case, the goal would be to gain international prestige and influence and revenue would be secondary.

A third is to provide Government service, in which case the service to U.S. institutions and consumers and cost becomes the paramount measurement.

Profit is not necessarily the objective. The only practical mission for DOE, I believe, is that of functioning as a Government service. A real business cannot operate in a political environment.

Events have shown that enrichment services cannot be political services. DOE can provide reliable service and reduce costs and they have obviously taken steps in this direction. A choice has to be made.

DOE cannot pursue all three missions. They are contradictory and sometimes incompatible. In other words, I think DOE is sometimes being asked to serve too many masters.

The media often highlights various items that portray DOE in a state of crisis or near-crisis. DOE's enrichment business has been compared with Chrysler problems and other terms have been used to suggest that it is in very difficult straits.

Change, of course, is being forced upon DOE, but I do not see that as unique. In fact, I see DOE's position as quite secure as long as expectations are brought into line with market realities.

I see no possibility that DOE would be forced out of business. I see no possibility that DOE will be reduced to a production level capability below that needed to meet U.S. needs.

I see no possibility that DOE will not remain a dominant U.S. supplier.

The uncertainty facing DOE is not one of survival, it is one of size. A long history of U.S. supply to foreign markets exists. U.S. industry has maintained a technical lead in the power industry.

As long as that technical lead was significant, U.S. suppliers sold to foreign markets. Nationalism occurs with development of domestic capability. The urge was to be self-sufficient.

In time, that urge was satisfied in all the other power areas. The means a U.S. company used to maintain a presence in the nationalistic markets included technical licensing, joint ventures and direct investment.

None appears practical for DOE. The same nationalistic problems and trends are affecting DOE's supply now, and will do so more so in the future.

Few, if any, companies have found it profitable to pay the cost of overcoming nationalism with price reductions. I doubt that DOE will, either, in the longer pull. But even if DOE chose that course, what would be the purpose?

Is there any reason to invest either in the United States or overseas unless a profit can be realized? What profit should a nonprofit organization expect? These are questions of basic strategy, and it seems to me that they will have to be answered sooner or later.

U.S. utilities will provide strong support to DOE. They will encourage some competition. That is the only leverage they have on DOE. But DOE need have no fear of being seriously hurt.

Any private U.S. company would be thrilled with an 80-percent market position and no domestic supplier competition. Competition in the U.S. market is relatively new to DOE. A secondary market supplied by non-U.S. suppliers is only a couple of years old.

Competition from primary suppliers for long-term contractors has only recently begun. The secondary market consists of selling enriched uranium and/or SWU commitments by users who bought in excess.

Deliveries are mostly short term. I am not aware of secondary market deliveries which extend beyond 1990. Approximately 4 to 5 million SWU from non-DOE produced sources have been sold into the United States via the secondary market.

This figure is a little different than the one mentioned earlier, because I think DOE SWU was included in that secondary market figure.

My figure is only European-produced SWU. More will probably be sold in the near-term, but the amount will probably stay in the range of 10 to 15 percent of U.S. consumption for the next 5 years.

The secondary market in one form or another is here to stay. It is the means by which imbalance is corrected. No one anticipates the primary supply contracting will produce a perfect balance without aid from the secondary market.

We do not see that market, however, continuing at the present level of activity. One method of maintaining or increasing DOE market shares incremental pricing, a lower price would be derived by eliminating certain cost elements presumed to be ongoing in any event.

The media has mentioned possible prices in the range of $60 to $80 per SWU. While this would probably help DOE's short-term and possibly intermediate-term market position, it is not at all clear why this would serve a useful end.

Why sell SWU at or near the power cost? Why subsidize foreign manufacturers with low-cost power? Some of those are more political questions than business questions.

Assuming that the law continues to require full cost recovery, who is to make up the loss on underpriced SWU? Moreover, the United States has talked from time to time about criticizing foreign suppliers for dumping.

Anti dumping action has been considered, but how does this approach legally fit with announced plans to sell U.S. SWU at less than cost?

Perhaps there are better answers to these questions than I am aware of, but even granted that are the merits of more production worth all the problems, inconsistencies, and counterproductive foreign relations?

It is important to keep in mind that international competition is not merely cost versus cost competition in the SWU business. Prices are not only set by profit motives, but by nationalism, currency needs and other non-cost-related influences.

Supplier competition is of a kind that yields what I would call soft pricing systems. Governments control all SWU suppliers. No one likes to back off from a price challenge. A downward price spiral is easily set off but ended only with difficulty.

As the highest price supplier, highest cost producer and the highest volume producer, DOE carries the pricing banner throughout the world.

Research and development for SWU is uniquely oriented. A new and different SWU is not needed. All producers supply comparable service. Improved quality is not required. There is no customer to satisfy with quality. SWU has only one application.

There is no opportunity to invent new and better uses for SWU. The focus of research and development has to be on a single item, and that is cost reduction, because that is the only worthwhile goal. And because investments expected to arise out of technical results are so huge, true production costs must be known.

Preliminary estimates, based on laboratory costs, are not sufficient judgments for investments of this magnitude. Test facilities, it seems to me, must be built on a scale where the results can be trusted.

To me, this means, for example, that the laser technology must be tested on a significant scale as diffusion technology already has, and as centrifuge technology will soon be. The major variables of facility costs, operating reliability and so forth, need to be known.

Moreover, the institutional and organizational costs need to be known. A free-standing operation for one technology cannot be compared with one utilizing a technology of a different type, but which may be burdened with management problems, union problems, political problems, and problems of other types.

The point I wish to make is that the limited use of the technology, the size of investment required to utilize it and the long research to production cycle that is involved, require slow and thorough testing for both technological soundness and costs.

The record in the nuclear business is that accurate costs are not gotten easily or quickly. Switching technologies is not usually a near-term solution.

A quick decision is likely to be a gamble. A gamble is not likely to solve problems. The need is to proceed far enough so that the residual uncertainty involves a risk rather than a gamble.

I would next like to summarize. The main theme that I had hoped to stress was the need for a clear-cut definition of DOE's role. Is DOE supposed to function as a business, a political instrument or as a public service?

One cannot criticize or praise DOE for doing what it is doing without a basis of measurement.

One does not know whether DOE is fulfilling the right role or doing the wrong thing right. Once that mission has been clarified, a number of questions can be answered, such as some of the following:

How important is market share? What is the optimum production level? This relates, of course, to number of plants. What is the proper pricing strategy and for what gains? When should new facility investment be made, for what beneficiaries?

What is to be done for foreign markets and at whose expense? How should U.S. utilities be protected from losses resulting from overseas supply? These are only a few of the questions, of course, that relate back to the role of a business or company.

I do not like to conclude with questions rather than suggestions, so I would like to add a couple of conclusions by summarizing a little bit more.

The first of these is that DOE's marketing problems are not unique. They are the result of domestic competition and the gradual drying up of an overseas market as nationalism takes hold.

Numerous private businesses have gone through the same process and same cycle. They have adjusted and survived. DOE will also.

The second is that there is always a danger of overreaction to a situation such as this. One's natural instinct is to believe that a good offense is the best defense. That may be true in many situations, but not in all.

Using resources at less than cost is not usually productive. I think it is especially undesirable when the costs of doing so create short-term liabilities now that would have to be liquidated later by DOE's most loyal clients.

Third is that it seems to me that what we don't know clearly is more important than what we do know. That relates again to my basic point concerning a need for clarification of DOE's role.

Each policy, plan and strategy ought to face the test of the question, for what purpose? If the answer is not clear, then either the objective is not clear or the means of achieving it is not clear or both.

This, of course, goes back to the basic choice between using DOE as a business, a political instrument or a Government service.

I find it in my own company that a board of directors is a most useful body. It focuses one's attention. It is a reminder to management that the aim of the business is not merely to serve management.

It provides a detached perspective that those of us submerged in day-to-day operations do not always have. I believe an equivalent body would be found useful by both DOE enrichment services and Congress.

The purpose could be much the same as for a corporation, evaluating policies and strategies, evaluating performance, representing the shareholders, the taxpayers in this case, and so on.

I think with such a body that DOE could probably get more flexibility from Congress which in my view they really need to operate their business.

I hope these comments have been provocative and useful. I would, of course, be happy to answer any questions.

Mr. LEE. Thank you, Bob.

Are there questions of Bob Wolcott?

Dr. WHITTENBURY. You were making some indirect suggestions about capital investment and what the utilities should be expected to pay back in the future. Do you want to be more explicit about that?

Mr. WOLCOTT. What I think will happen is that the overseas market will decline for DOE in the longer pull. You need to make the assumption you can stay there or the assumption that you can't.

I would work on the assumption that you can't stay there, which means the volume would eventually drop off in the overseas market.

If they receive price concessions now and opt out of our system to use other suppliers later on and if this results in cost increases which I would expect, then I think the U.S. utilities may have to pick up the liabilities that would be created in the short term.

Mr. LEE. Bob, what are your views on the impact on the secondary market by relieving electric consumers in this country of their take-or-pay obligation under the old fixed commitment contracts?

Mr. WOLCOTT. I think the contracts that DOE has come up with have been very helpful, because they have provided flexibility that has allowed people to work off the excess inventories which they had or the excess commitments which they had.

Our belief is that those commitments will be worked off and those excesses will be worked off around 1990, which is the same figure that I believe DOE mentioned today. I think that was a very good move on the part of DOE.

Mr. LEE. I hear you suggesting that DOE identify its sort of philosophical role a little bit, and I have read some of your writings that sort of conclude that it should emphasize its Government service role more than its business or political role, isn't that so?

Mr. WOLCOTT. Yes, that is right.

Mr. LEE. I am under the impression that the Postal Service has made moves to meet business competition with super-overnight air express and with electronic mail and some other things, and that the Postal Service has applied business techniques top managing and controlling its costs, so that we have seen a stable Postal Service cost, and they have made a little profit in the last few years, isn't that so?

Mr. WOLCOTT. Oh, yes, I think so.

Mr. LEE. They are sort of an amalgamation of a Government service with a business bent, wouldn't you say, to meet the competition that the business world has thrown at it?

Mr. WOLCOTT. I wouldn't want to suggest that I don't think cost reductions are not a good thing and to the extent they are business like, I think that is very good. I think the competition such as the Postal Service has had is very good for the Postal Service, and I think it is good for DOE.

But I do have questions about when you go to a place like Japan, where we are making special efforts to hold the Japanese market, I doubt if the Postal Service would be very interested in going over and trying to handle the Postal Service in Japan.

If you are a private enterprise and if you saw a chance to make a large profit in Japan for a substantial period of time, that would be worthwhile, but it doesn't seem to me to be a very good thing to just cut prices and try and stay in that Japanese market, first, if you can't do so long term; and second, if there is no benefit to the U.S. taxpayers or consumers or U.S. utilities.

So it is in these areas that I had the most concern about what are the true objectives of DOE.

Mr. LEE. If DOE can sell SWU's overseas at a price higher than their incremental cost of that volume, are not domestic consumers helped?

Mr. WOLCOTT. There are pricing strategies for overseas that could help U.S. producers.

Mr. LEE. U.S. consumers?

Mr. WOLCOTT. U.S. consumers, excuse me. This is why I think you need to separate the foreign from the domestic strategy just as a private company would, but I think whatever strategy we use for the overseas, we should be able to demonstrate that that actually helps the U.S. consumer.

I question whether there is much advantage, for example, in investing in facilities which are sufficient to serve the overseas market, but which uses taxpayers' dollars, then selling that without a profit, furthermore, probably having a fairly short life, maybe 10 years, something like that.

Mr. LEE. Thank you very much.

Walt?

STATEMENT OF WALTER H. WOLFF, PRESIDENT, SWUCO, INC., GAITHERSBURG, MD

Mr. WOLFF. I am Walt Wolff, I am president and CEO of SWUCO, Inc. I will take a different tact than Bob did, because I want to be more with facts, figures and perceptions as opposed to trying to provide managerial guidance.

If DOE had originated back in 1973 the U.S. contract, I wouldn't be here today. I would probably still be working at GE. DOE in 1972, through the fixed commitment contract, created the possibility for the secondary market.

This, of course, was due to, in large part, the interest of privatizing the enrichment venture to put it on a business-like basis and DOE, AEC, ERDA, did its best within the constraints of what I call congressional and management thoughts within the administration to aim in this direction.

In 1975, of course, there was a relief of commitments including terminations at no cost.

As a matter of fact, six weeks later, two utilities were calling us, saying, "Can you help us get rid of some SWU's," it was that fast.

In 1978, they introduced the AFC contract. Sherry's presentation was an accurate chronology of how the marketplace evolved. This took the first step toward allevating the buildup of SWU commitments that had occurred in the United States and with DOE consumers, but did not solve the problem.

In 1978 was when the first secondary market transactions of any substance started to occur with the encouragement of DOE, because it was recognized that they were unable under the system they were working under to relief the problems that they had originally created.

In the timeframe from 1978 to 1984, approximately 9 million SWU's have been transacted through assignments approved by the DOE and the total secondary market transactions for sales on the order of 13.6 million SWU's.

These, of course, are not all DOE. These are approximately one-third non-DOE.

This occurred primarily because of the difficulties that were created back in about 1980, when certain U.S. utilities, perceiving an immense and tremendous cash flow problem, said, we have to do something.

We will sell 10 cents on the dollar. This was the first time that the requirements contract itself was used as a mechanism for accepting SWU's through termination. The U.S. utility terminated its requirements contracts and accepted purchase from another U.S. utility of a large commitment of SWU's.

The secondary market continued to be essentially active in only DOE SWU's until 1981, when the EURODIF shareholders finally decided they had to do something because they were building up a tremendous intake from the EURODIF project as shareholders, yet the Spanish program was very slow, the Italian program a disaster.

Only the Belgian and French programs were using up production. The only people who have sold EURODIF commitments are the Italians and the Spanish.

In 1981, there was a first transaction when the SWU's coming out of Europe entered the U.S. marketplace. Where originally we saw discounts on the order of $3 to $5 below DOE price, net discounts, we began to see discounts of 10, escalating to 15 and 20, and it became a very, very chaotic marketplace.

Of course, in this marketplace, DOE had the perception and I think a very real one, that they are going to lose business. I agree with Bob, there was never a danger that DOE was going to be put out of business, but there was a threat that they would lose a goodly fraction.

I think the responsiveness of the U.S. contract recognizing the existence of competitors allowing for the buyer to choose up to 30 percent from another party was a very good move.

Unfortunately, I think it is too little, too late, at least in the overseas marketplace.

Frankly, in Europe, I think that the DOE, not through their own fault—Sherry commented, DOE has looked at, no matter whether it was the NRC or Congress or the administration or Department of State, DOE catches the heat, because they have to live with all the governmental policies that are imposed upon them, witness the situation with South Africa, the embargo, these things were not the doing of DOE, but they were the victims, and hence, were being penalized.

It is for this reason that in my opinion, no one in Europe except for the Spanish, if they can get the right concessions, maybe one Swiss and one Swedish utility, maybe the Yugoslavs, will convert.

The rest will not. In Asia, I think they will all convert. The Japanese, I think, are getting tired of coming to the United States under the terms of the Nuclear Nonproliferation Act to request reprocessing permission, but because they are friends, they will commit to stay with the United States, but in the 1990's, they will have their indigenous production and the 100-percent commitments that the United States has today will dwindle to 70 percent at that time.

I think the same objection will be true in the United States. While many utilities are committing 100 percent today, as of 1991 they have the right to change to a 70–30 mix, and URENCO and COGEMA are extremely active in their marketing in the United States and overseas.

There are certain U.S. utilities that will not convert because they either have already signed long-term commitments and terminated—these are requirements contracts, the 3½-year mode, and therefore, DOE has lost them, maybe not forever, because is some of the miracles that are forecast, either AVLIS or AGC come to pass, and the prices are right, the U.S. utilities will turn back to DOE.

Overseas, I think those people are lost forever. I think trying to recognize it is lunch hour, I just have, I guess, one other small comment.

The secondary market will be out of business within 2 or 3 years. I disagree very strongly with Bob, because as of 1987, the excess DOE commitments will be used internally by the contract holders.

Duke Power is a good example. In 1987, they have the right to use inventory up to 100 percent of their needs. Other utilities are negotiating the same position. That is a lot better way to go than to sell at $50 off the DOE price.

So, you will see few DOE SWU's in the marketplace with the exception of certain parties holding contracts who are not converting, the Europeans, but that is a very limited supply, and will be gone in a very short time.

The partners of EURODIF, with the exception of one party, have agreed to let COGEMA market the output. This is a primary supplier who is very active. URENCO also is very active, so from the point of view of a secondary market, what is going to be left is COGEMA and they probably will be out of the market by 1990.

So, I think the secondary market will be gone. I am looking for work. The U.S. contract has done that job and DOE is to be commended because when we saw the first draft at the end of 1983, our view was that very few people would accept it, but the very, very good work that was done to get the contract—I am not looking for a job with DOE, thanks—that it has done in coming out with the final form is extremely effective and very responsive.

My final comment is an objection. It is unfortunate that the people at DOE headquarters and DOE Oak Ridge do not work more closely together, because they have seen instances over the past years where people have shot themselves in the foot.

I was half-tempted to bring in a pair of metal-covered shoes so I could hand to somebody at DOE just in case it happened this morning, but it didn't.

I will leave with you a speech I gave at the ANS in April which has a lot of facts and figures. You might find it interesting.

Mr. POTTER. I would like both of your views on Sherry's charts reflecting future capacity and future world demand. I don't know if you recall these charts.

Mr. WOLFF. Capacity, yes.

Mr. POTTER. It seems to me by the comments that Bob made, which made sense about soft-pricing methodology, if you will, and the comments that you made, Walt, about motivation, that an important factor in the future of this enterprise in the United States is how much capacity will be available worldwide and how much demand will there be worldwide, and I wondered if you had a separate view about these two issues?

That chart—that table and the next chart.

Mr. **Wolff**. That is about the same as our figures. We have approximately 40 million SWU of United States and European capability, and that is augmented by 4 million SWU from the USSR, 44 million available supply in 1984, and this is about twice current worldwide demand of 24 million SWU.

It even exceeds a forecast 1997 assumption of 36 million SWU by 22 percent, so there is really more capacity than the world needs under almost any circumstance. I think the kind of competition that arises from overcapacity is bound to continue.

Mr. **Potter**. You used a number of 1997.

Mr. **Wolcott**. 1997, right.

Mr. **Potter**. What was that number?

Mr. **Wolcott**. That is 36 million SWU consumption. That is what the reactor is actually using, which may be a little different than what the utilities buy at that time.

Mr. **Potter**. Yes; that is the next——

Mr. **Wolcott**. Pretty close, I would say, to the figures which DOE has now.

Mr. **Wolff**. I have no quarrel with that except for one qualification. The French nuclear program is moving very well. If one projects the needs of the French reactors and also the actual needs of the remaining EURODIF shareholders, the EURODIF commitment will be fully booked up by 1992 or 1993, without additional capacity being built by the French.

I am not saying they won't, but there was a regionalization in terms of supply and demand which has to be recognized.

In supply, we are talking about a Japanese plant. The EURODIF plant will be fully booked and what the French will do at that time is hard to say.

Mr. **Potter**. Turn back to the chart. Do you agree with those numbers?

Mr. **Wolff**. Yes.

Mr. **Potter**. Is it possible to make a guess about years beyond 1990? If they are going to be booked, are they going to add a lot more capacity?

Mr. **Wolff**. If I could read George Best's mind, I could tell you. I don't know. I suspect, having dealt in the marketplace as both ally and competitor at different times, that they will expand their technology and will put on additional capacity, first because they have their own program, second because they are interested in exporting, and this is, of course, looking at Taiwan, looking at People's Republic of China looking at Korea, where they have been successful, and other places where they would like to sell reactors.

Mr. **Potter**. So, if you looked at the year 2000, actual numbers, and you saw larger capacities in France, the United Kingdom, Japan, than as shown for 1990, you wouldn't be surprised?

Mr. **Wolff**. Not at all. I think that would be business lost to DOE.

Mr. **Potter**. Moreover, you think that it would be——

Mr. **Wolff**. At the expense of the Department of Energy.

Mr. **Potter**. Of the 39 customers that they have?

Mr. **Wolcott**. I think that could happen fairly rapidly, because the EURODIF people feel they could increase the capacity of their plants 25 percent.

Mr. **Potter**. From what is shown here?

Mr. **Wolcott**. Yes. URENCO uses the small centrifuges and they can expand by modules in a matter of only a few years, so if they can get the business, they can add. Although Japan is scheduled to produce only one-third of its domestic requirement by the year 2000, it uses about the same process as URENCO, and I think if it is successful, it may expand much more rapidly than that, partly because the production company itself will be owned by the utilities who use it.

Mr. **Potter**. They will just privatize that?

Mr. **Wolcott**. Yes. It is shown here at PNC, which is a Government-owned company. PNC did the development, but a production company is being formed and will be owned by the utilities.

Mr. **Lee**. Walt, you supported the new DOE contract, and your criticism of it was that it was too little and too late. What in your view would be in the interest of the consumer, i.e., taxpayers in the United States, with respect to other changes in that contract?

Why too little, why too late? What is in the interest of the United States?

Mr. **Wolff**. The difficulty was, if that contract form had been introduced in 1973 or 1975, or even 1978, I think that first, we would not have seen the kind of secondary market that came to pass, and I am happy it did, believe me. So is Bob.

But essentially, the market——

Mr. **Lee**. That is the too late. Can you address the too little now?

Mr. **Wolff**. I think altogether too little, it is a good contract, I think it is an adequate contract. I think it gives the customer flexibility, VTO at a modest price, he should be very happy.

When I say too little, too late, I am taking the whole phrase out of context. It is too late, it is not too little.

Mr. **Lee**. I think your fixed commitment customers would agree with that.

Mr. **Wolff**. Even the requirements people are kind of happy.

Dr. **Whittenbury**. There was a point you made about the use of inventory, that if a customer has inventory or has access to a secondary market, he does not have to take the 70 percent, is that right?

Mr. **Wolff**. No. The conversion program has allowed those utilities who have DOE-origin material in inventory at the end of fiscal year 1986 to apply such inventory against their future direct purchase commitments with DOE, so instead of buying—if they committed to 70 percent of their needs to purchase in 1987 directly from DOE, that can be reduced to zero provided they have DOE source inventory still hanging over their head, not non-DOE.

Dr. **Whittenbury**. How much is that altogether?

Mr. **Wolff**. John Longenecker said 40 million. I couldn't subscribe to that. There is probably 8 to 10 million SWU's in excess inventory of DOE origin. This is today, Mr. Whittenbury.

By 1986, a large portion will be gone, because DOE has relaxed the rules about what you are doing in 1984, 1985, and 1986, and it will probably be down by a factor of two.

Mr. **Mead**. You imply that European producers will effectively take over all of the European customers. Do you see those European suppliers taking dead aim on U.S. customers?

Mr. **Wolff**. Oh, yes, very much so. COGEMA has established an office in Washington called COGEMA. EURODIF is really COGEMA as the marketing arm of the plant. URENCO has established an office in Washington, and I know they are calling customers around the United States convincing them to sign up 100 percent by terminating and others to take 30 percent.

They are very aggressive.

Mr. **Lee**. And there have been a number of sales.

Mr. **Mead**. Do you see them expanding their production capacity in order to do this?

Mr. **Wolff**. URENCO has a centrifuge technology, a modular approach, small machines vis-a-vis large machines, with a 2- to 3-year leadtime EURODIF can get more efficiencies out of its diffusion plant, so they can expand their capability.

They can make deals with their shareholders who don't want their SWU's, that they will take them away and sell them for them which they have done in part.

Mr. **Wolcott**. I might add in answer to your question, we estimate there are close to 50 million SWU's in inventory, and of that, roughly 10 million is in the United States, a little over 20 million in Europe, and not quite—about 15 million in the Far East.

Mr. **Lee**. Wouldn't that inventory have continued to grow had DOE not changed the contract?

Mr. **Wolff**. Yes.

Mr. **Wolcott**. Yes; it may continue to grow anyway, so because I don't think EURODIF has been quite as agreeable to cutting back on its production requirements as has DOE. So, according to our figures, the European inventory will go up a little bit, but also the Far East inventory will go up, and those are all DOE customers.

Mr. **Lee**. We thank you for being with us and giving us your forthright views. Let's be back and ready to resume business at 1:30, please.

[Whereupon, at 12:45 p.m., the subcommittee recessed, to reconvene at 1:30 p.m., the same day.]

AFTERNOON SESSION

Mr. **Lee**. During the lunch hour, the committee decided to continue me as chairman.

We will first hear from John Longenecker.

Mr. **Longenecker**. We would like to continue the presentations that we had this morning. The next element of information that we would like to present, and very briefly, is an idea of exactly what it is that we do for the customer in Oak Ridge in assuring the reliable delivery of the product to them.

That presentation will be by Ewin Kiser, assistant manager of the Oak Ridge Operations Office for Enriching Operations.

Mr. **Lee**. Glad to have you.

STATEMENT OF EWIN B. KISER, JR., ASSISTANT MANAGER FOR ENRICHING OPERATIONS AND DEVELOPMENT, OAK RIDGE OPERATIONS OFFICE

Mr. Kiser. What I will be doing is giving you a very condensed overview. The enriching of uranium was established in 1969 to provide enriching services for the nuclear fuel cycle.

The umbrella under which we and the customers operate is a contract of the type you have heard Sherry discuss this morning. The people providing the services are a combination of ourselves and our operating contractors, Martin Marietta and Goodyear at Portsmouth.

The services that we provide are not unlike the kinds of things that you find in a normal operation in private industry. There are some unique things that do tend to make it a little different.

By and large, the most sizable thing we do is to provide specific quantities of uranium at specific assays to meet the customer demands.

We work very hard to tailor those services and others to the unique demands or needs of each customer. However, there are things other than supplying uranium such as, again, as one would find in any business arrangement, arranging for transportation, temporary storage materials, much as you would have with anyone.

We interface with the converters of U^{308} to UF^{6} on one side, as a feed supply, and with the fuel fabricators on the other.

We also work as necessary to facilitate assignments of material from one contractor to another for whatever reasons he might wish to.

The customer, because he is supplying large quantities of different materials of high value, also needs information services such as material balances and we provide those rather routinely.

DOE ENRICHMENT SERVICES CUSTOMERS

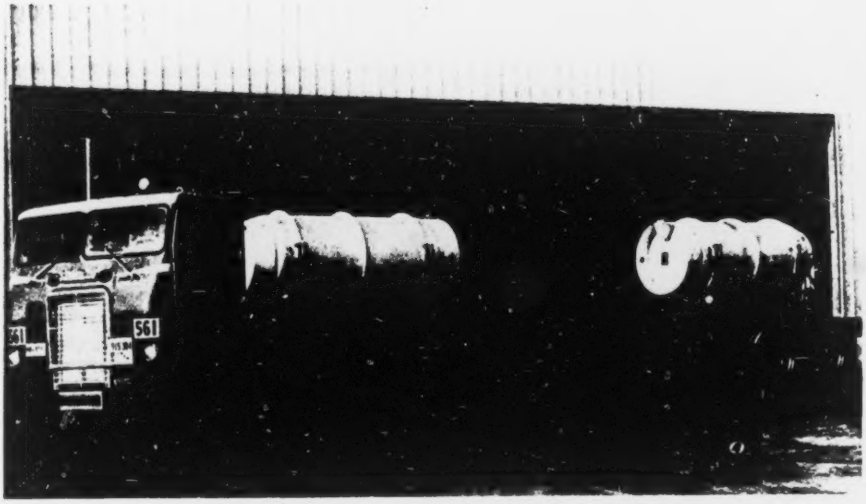
UNITED STATES	
PRIVATE UTILITIES	43
PUBLIC UTILITIES	8
SUB TOTAL	51
NON U.S.	
PRIVATE UTILITIES	19
GOVERNMENT OWNER UTILITIES	6
GOVERNMENT AGENCIES	2
MULTI-GOVERNMENT AGENCY (EURATOM)	12
SUB TOTAL	39
TOTAL	90

The customers we are dealing with are characterized here. There are the 90—51 United States, 39 non-United States. The non-United States are somewhat different in character from the utilities in this country, in that you begin to see that we are dealing with government entities.

There are government-owned utilities that we deal with, such as Taiwan, Philippines, Korea, Egypt and others. We deal with government agencies, such as agencies of France, agencies of Mexico.

And then there is the multigovernment agency, EURATOM, which is the agency for Germany, Belgium, Netherlands, and France.

UF_6 FEED CYLINDERS ARRIVING AT PLANT

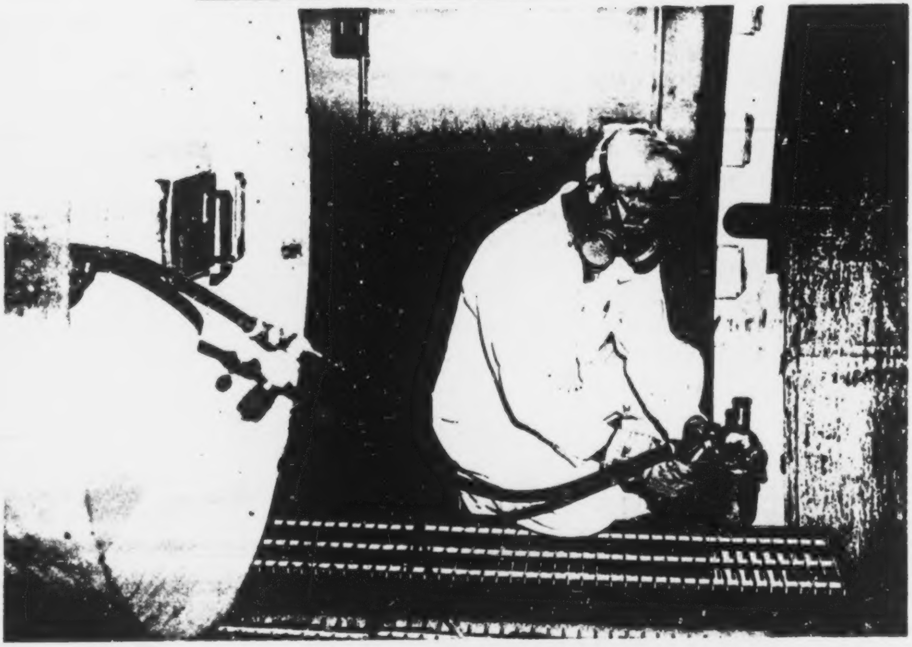


A typical customer delivery is received by truck. An annual reload would approximate 150 metric tons of uranium, which we would receive as UF^6 from a U^{308} converter. Converters in this country are Allied and Sequoia Nuclear.

We also receive UF^6 from three principal suppliers overseas, foreign suppliers, El Dorado, Canada, and the French Co.

Feed is delivered 90 days prior to the need of the product. We sample, analyze, and then take title. Because of the large value of the material, the sampling is very important, both to our customer and to ourselves.

UF_6 CYLINDER SAMPLING OPERATION



This illustrates the careful pulling of samples from cylinders. In this case, we take two, one for our own analytical and one for the referee, if we differ from the customer.

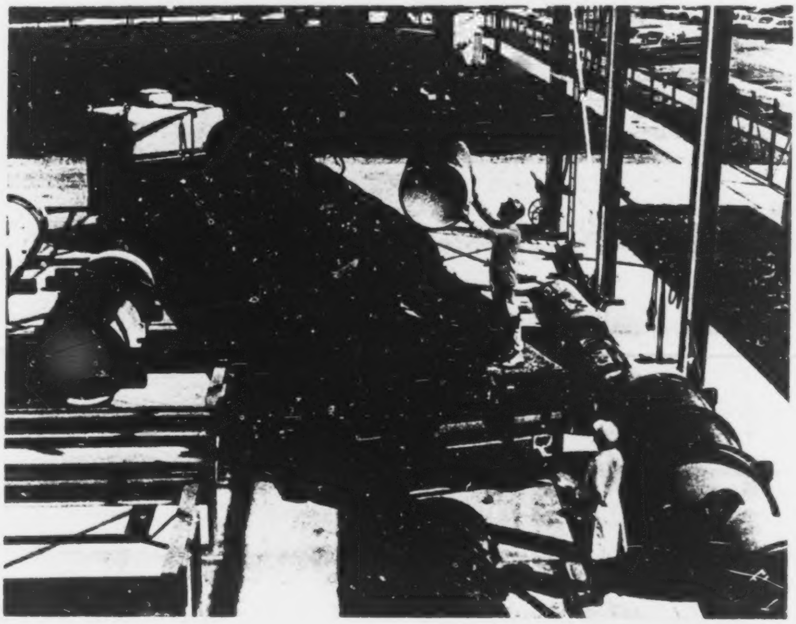
TOLL ENRICHMENT FACILITY UF_6 TRANSFER OPERATIONS

The next step in our business is to produce the desired material specially tailored to the assay and quantity from the customer. His orders are placed 180 days in advance of delivery—typical annual reload, 25,000 to 30,000 kilograms, and from one to eight assays.

We have the opportunity and choice to ship the material itself directly from production or from inventory, whichever fits the circumstances at the time. The order may be picked up by the customer at that time, or if he needs the material later, it could be stored temporarily.

Product shipment, again, is a big item. At this point, we are shipping 2 to 4 percent uranium, very valuable, very careful analytical work is required. The customer has the option to visit, to witness the weighing and sampling, and we lean over backwards to make sure that any of these things he wants to do, we make sure he can participate in.

LOADING OF ENRICHED PRODUCT



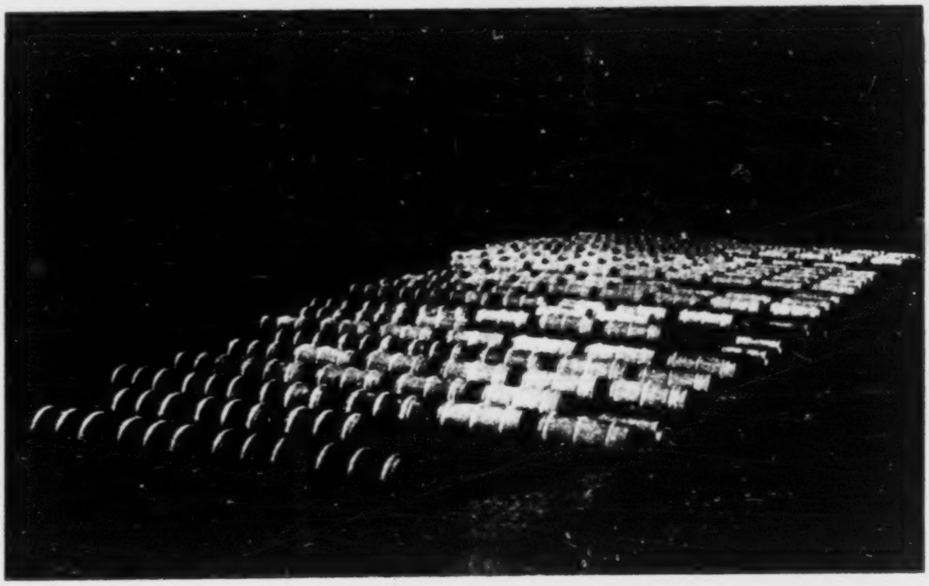
Shipping documents are then prepared. The agent, in most cases the fuel fabricator, is notified, and he picks up his cylinder, and again, by commercial transportation—this time, since the uranium has been enriched, the containers within which it is stored are much smaller, 2½-ton cylinders here being loaded on a commercial truck, with packing—overpacks we call them—which have structural integrity in case of a break, so that the cylinder doesn't get damaged.

I think we can characterize our business as big. We delivered 254 orders last year consisting of 100 different individual assays. So we tailored our business to what the customer needs.

There are other special services. I mentioned a few. Again, not unlike any business in private enterprise, we have to work with our customers, we interface with his agents, and we keep in continuous contact to make sure our services are meeting his needs.

One activity that is quite large, that we are involved in, as a recipient of some of the customers' material, is that he has an opportunity to either reclaim his tails, the depleted stream, or leave them with us.

TYPICAL UF_6 CYLINDER STORAGE YARD



If he leaves them with us, the title changes to DOE, and we have accumulated over time some rather large stockpiles.

Some of the other things we do is to respond to the extent we can, if he has an emergency situation, finds himself short of fuel for the reactor, we can waive the usual time requirements and help him to meet his needs.

There are a lot of odds and ends of things that we do that you run into in normal business. We may get one of his cylinders for filling, find that it is somewhat dirty, needs to be cleaned out. We will either make arrangements to get it cleaned or we will clean it and charge him for it.

Similar things—other parts of the equipment. A valve might be slightly damaged. We can arrange to have it fixed, so he is not held up on his deliveries.

Without being perhaps too presumptuous, from our feedback from the customer, I think we do a reasonably good job. That is my presentation.

Mr. LEE. Questions?

For the panel's information, as one customer, I will confirm Ewing's last statement. They do do a good job. Thank you, Ewing.

Mr. LONGENECKER. Mr. Chairman, we think that service is one of the things that has made us attractive as a supplier in the past, and we plan to continue that, and also to continue working with customers to assure if there are other needs they have, that we can meet them.

If we could, I would like to proceed to the next portion, and that is to discuss with you how we put together an operating plan.

To preface that discussion, we discussed this morning a need for stabilizing and rationalizing the marketplace, putting supply and demand into balance, and developing a firm estimate of what portion of the market that we would serve near term and long term.

And then, based on that, make the basic operational decisions, when to phase out gaseous diffusion plants, how much capacity we need over the next 10 years in any given year, and when we should build new capacity.

All of those are involved in our overall production and strategic planning.

We have two planning functions: There is one in my office in Washington that does overall strategic planning. They work in close cooperation with the operational planning group in Oak Ridge. And despite other comments to the contrary, in the last year, we have all taken off our steel shoes.

Today, I would like to describe for you the preparation of our annual operational plan, how it is done, and the basic elements of that.

Making that presentation will be the head of the operational group in Oak Ridge, Joe Parks.

STATEMENT OF JOSEPH W. PARKS, ASSISTANT DIRECTOR FOR PLANNING, OPERATIONAL GROUP, OAK RIDGE OPERATIONS OFFICE

Mr. Parks. I would like to touch briefly on items that we consider when we put the plan together, and then look at the interim working scenarios which you all have received.

OPERATING PLAN PREPARATION

JOE W. PARKS

AUGUST 16, 1984

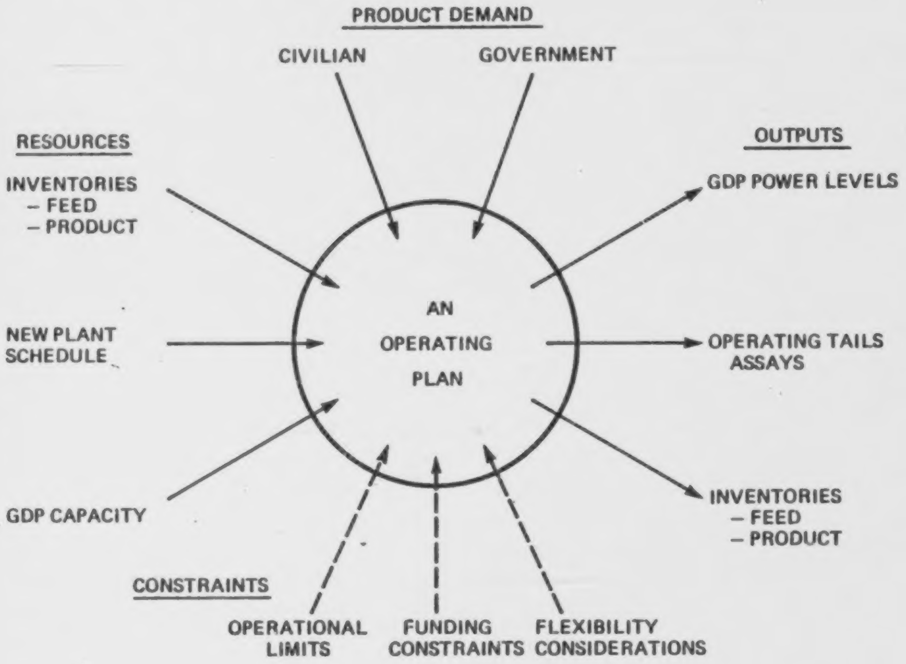
DOE URANIUM ENRICHMENT OPERATING PLAN

- A LONG-RANGE PLAN FOR OPERATION OF THE DOE URANIUM ENRICHMENT COMPLEX TO MEET PRODUCT DEMAND
  - PLANNING HORIZON IS ABOUT 15 YEARS
  - DYNAMIC, USUALLY REVISED ANNUALLY
- OBJECTIVE: PROVIDE AN EFFICIENT AND COST EFFECTIVE PLAN TO MEET ENRICHED URANIUM DEMAND WITH FLEXIBILITY TO ACCOMMODATE FUTURE CHANGES
- PROVIDES FOCUS FOR:
  - DOE BUDGET SUBMISSION TO CONGRESS
  - CALCULATION OF SWU PRICE
  - OTHER ANALYSIS (CASH FLOW, POWER NEGOTIATIONS, ETC.)

What is an operating plan? It is a long-range plan that covers about 15 years. It is dynamic. We have to redo it annually and usually less than that to keep up with changing conditions.

Of course, its objective is to provide a cost-effective plan for supplying enriching services. It provides a basis for the DOE budget submissions, calculation of the SWU price, and other cash flow analysis.

PREPARATION OF THE URANIUM ENRICHMENT OPERATING PLAN



Here are some components that go into a plan as well as go out. Your requirements—your product demands, have to be the input. Your resources are inputs. Constraints. Outputs are operating tails, GDP power levels, and inventories through time.

RESOURCES

- INVENTORIES OF FEED AND PRODUCT
  - 44 MILLION KgU FEED
  - 15 MILLION SWU PROJECTED FOR BEGINNING FY 1985
- EXISTING PRODUCTION FACILITIES (GDPs)
  - 3 GDPs
  - MAXIMUM CAPACITY 27 MILLION SWU AT 7400 MWe
- NEW PRODUCTION FACILITIES
  - ADVANCED GAS CENTRIFUGE (AGC)
  - ATOMIC VAPOR LASER ISOTOPE SEPARATION (AVLIS)

Resources. We have 44 million kilograms of natural uranium feed, 15 million SWU. We have three GDP's that can produce 27 million separative work units, and two technologies under development.

CONSTRAINTS

- OPERATIONAL
  - MINIMUM/MAXIMUM GDP POWER LEVELS
  - NOT FEASIBLE TO SHUTDOWN-RESTART GDP
  - MINIMUM/MAXIMUM OPERATING TAILS
  - MINIMUM WORKING INVENTORY LEVELS
- FLEXIBILITY CONSIDERATIONS
  - FLEXIBILITY TO MEET CHANGING DEMANDS
  - CUSTOMERS CAN CHOOSE TRANSACTION TAILS ASSAY
  - NEW PLANT SCHEDULES SUBJECT TO CHANGE
- FUNDING
  - MUST FUND PROGRAM OUT OF REVENUES
  - LONG-TERM DEMANDS (REVENUES) UNCERTAIN

Here is the hardest part. Constraints. Diffusion plants can only operate at minimum and maximum power levels. It is not feasible, we feel, to shut down a diffusion plant and restart it.

We also have minimum and maximum tails assays that these plants can operate. And we must maintain minimum working inventories.

Under flexibility considerations, we have to recognize that customers' demand change, and that also the customer can now choose his transaction tails assay and that new plant schedules change.

Funding, that is a limitation. We have to live out of revenues, and long-term revenues are somewhat uncertain, while near-term may be more ironed out.

DEMAND PROJECTIONS

- MAJOR INFLUENCES:
  - NUMBER OF NUCLEAR POWER PLANTS BUILT
  - POWER PLANT PERFORMANCE (CAPACITY FACTOR, FUEL CYCLE MANAGEMENT)
  - DOE MARKET SHARE

- STEPS IN PROJECTING CIVILIAN PRODUCT DEMAND
  1. PROJECT NUCLEAR POWER GROWTH
  2. ASSUME DOE MARKET SHARE OF FUELING REQUIREMENTS
  3. PROJECT PRODUCT DEMAND USING COMPUTER MODELS

- GOVERNMENT PROGRAM DEMAND BASED ON INPUT FROM DOE OFFICE OF NUCLEAR MATERIALS PRODUCTION
  1. NAVAL REACTOR REQUIREMENTS
  2. WEAPONS REQUIREMENTS
  3. PRODUCTION REACTOR SUPPORT
  4. RESEARCH AND DEVELOPMENT PROGRAMS

Let's look at the demand projections. What are the major influences on demand projections? Obviously, the number of plants to be built, their performance, their capacity factors, et cetera.

And thirdly, what share the DOE would project to get of that market. How do we make demand projections? Working with all available sources like EIA, NRC, State Department, media, customers, we come out with a gigawatt growth, then we make projections of the fraction that would be fueled by U.S.-supplied enriching services and then we use simple computer programs, using probablistic history of plant performance to come up with separative work requirements.

That is 80 percent of the demand. The other 20 is for government users. I have listed the primary users of that enriched uranium.

INTERIM WORKING SCENARIOS

PURPOSE

- PRELIMINARY LONG-RANGE OPERATING PLANS
  - USED IN DEVELOPING FY 1985 PRICE AND BUDGET
  - REFERENCE POINT FOR PROGRAM PLANNING PURPOSES
  - REFERENCE FOR DISCUSSION ON BUDGET AND STRATEGY
- WILL BE REPLACED IN EARLY 1985 AS CUSTOMERS RESPONSE TO DOE INITIATIVES TO STABILIZE MARKET IS KNOWN

Let's look now at the package you have all received. This is the interim working scenario. It was a preliminary plan generated in the February through April time period by DOE. It was used in developing the fiscal year 1985 price, $135 price, which Sherry discussed.

It was used as a reference point for budget planning, and also discussions on strategy which have been taking place within the agency. It will be replaced in early fiscal year 1985 as we get more detail on contract conversions to the new contract.

INTERIM WORKING SCENARIOS

NUCLEAR POWER GROWTH TO BE SERVICED BY DOE
(THOUSANDS OF MEGAWATTS)

YEAR	U.S.	NON-U.S.	TOTAL
1985	79	43	122
1990	115	53	168
1995	119	58	177
2000	119	59	178

Again, at that time, it will still be an interim plan, because we will not have technology selection. These the gigawatts that were used in that interim operating plan for the demand.

Several points I might make. The domestic gigawatt of 119 in the year 2000 compares with the EIA's forecast of 130 for the 1983 forecast.

So we are conservatively marking down this gigawatt growth forecast. Please notice that we are assuming essentially no new growth in the 1995 to 2000 time period that John Longenecker indicated earlier.

Mr. **Lee**. Question about that previous table. You show 85, 79 gigawatts U.S.

Mr. **Parks**. Yes, sir.

Mr. **Lee**. What are your assumptions with respect to additional cancellations beyond those units already canceled in 1990?

Mr. **Parks**. This forecast was done in the fall of 1983, which this was based on. It is almost a year old. In talking to the people that do the detailed tabulation of cancellations, there were some that were picked up, but I believe there have been additional cancellations since that time.

We can provide a list of which reactors.

[The information follows:]

U.S. REACTORS INCLUDED IN 1983 FORECAST THAT HAVE NOW BEEN CANCELLED

Reactor	*MWe*
Harris-2	915
Zimmer	810
Midland-1	492
Midland-2	818
Marble Hill-1	1,130
Marble Hill-2	1,130

Mr. **Potter**. But you don't guess at which other ones might be canceled?

Mr. **Longenecker**. Yes, we do a reactor-by-reactor count to get these. Probably the details of these, since this was for the interim working scenario, is not specific as to which reactors we assumed would and would not be completed.

But we do go through them one by one. In general, we find in our planning projections, which take them out before utilities do, before other parts of DOE do.

Mr. **Lee**. Whatever assumptions you make with respect to those not yet canceled, I suggest you keep to yourself. It will get your investors all upset. But what you saying really is, in this fall's update of this interim working scenario, it is likely the 1990 to 2000 U.S. gigawatts will be somewhat lower than shown.

Mr. **Parks**. That is correct.

Mr. **Mead**. Also the non-U.S. list here is in direct variance to our previous speaker's opinions.

Mr. **Parks**. As far as this was too high? To go into a little bit more detail on this forecast in particular, in Europe , there were numbers dropped out as contracts expired—some several plants.

But other than that, there was some assumed growth in the Japanese market, 4 or 5 gigawatts, which made that appear rather than going down it was flat. So there was some dropping out of the Europeans.

This is being looked at at this time.

Mr. **Mead**. That will also be updated?

Mr. **Parks**. Yes, sir. It is being updated at this time.

Mr. **Longenecker**. Mr. Mead, those are only gigawatt estimates. In addition, in preparing the plan, we also bias those for the percentage for each of those reactors which they take from us. So we still have not put that bias in.

We then translate that to SWU's.

INTERIM WORKING SCENARIOS (ASSUMPTIONS)

SWU DEMAND:
- "MOST LIKELY" FORECAST (122 GWe BY 1985, 178 GWe BY 2000)
- 75% OF ALL CURRENT CUSTOMERS CONVERT IN NEAR-TERM
- 70% OF CUSTOMERS' REQUIREMENTS TAKEN FROM DOE IN NEAR-TERM

SWU SUPPLY:
- SCENARIO A
  - GCEP PRODUCTION BEGINS FY 1986
  - AGC AVAILABLE FY 1989
  - FULL PRODUCTION OF 13.2 MILLION SWU IN FY 1995
- SCENARIO B
  - AVLIS PRODUCTION BEGINS FY 1993
  - FULL PRODUCTION OF 14.2 MILLION SWU IN FY 1997

Mr. PARKS. We have an assumed demand now for this interim scenario, which was the previous gigawatt forecast. We assumed in the early part of this calendar year, perhaps 75 percent of the customers would convert to the new contract and they would take the minimum of their requirements from the DOE in the near-term.

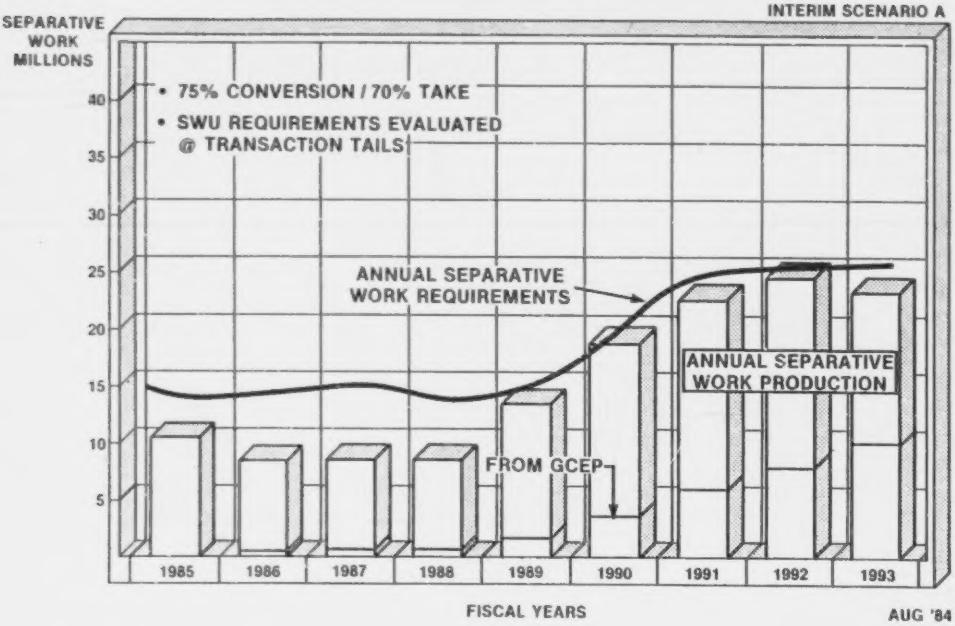
Again, we have only discussed demand input. Not knowing the technology selection until next May, we had to make two scenarios for supply, one being centrifuge, and the other one being the AVLIS facility.

This slide shows the production dates—the bottom bullet—the centrifuge plant would be completed in fiscal year 1994, but would produce its full name plate capacity in 1995.

Likewise, the AVLIS plant would be completed in 1996, with its full name plate production available for sale in 1997.

So we have two scenarios. Let's look at plots of the tables you have in your package and discuss some points on that.

ANNUAL SEPARATIVE WORK PRODUCTION AND REQUIREMENTS



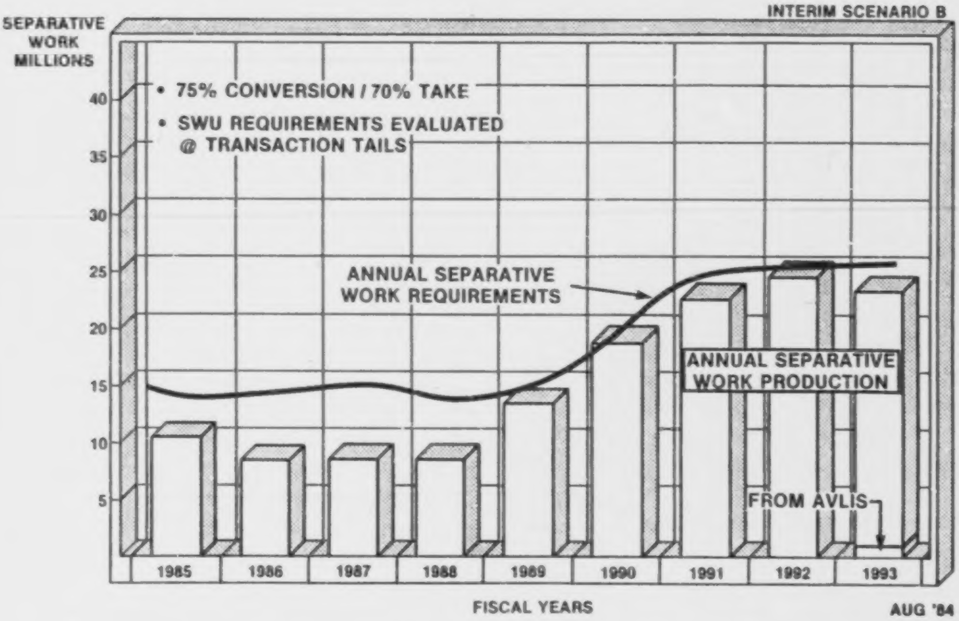
The yellow bars represent millions of separative work units, the production in the gaseous diffusion plant, if centrifuge is selected. This is scenario A. You will notice that during these years, the production of the diffusion plant is low, it is lower than the demand.

We are taking material out of the enriched uranium inventory. We reach our minimum inventory in the 1988–89 time period, and from then on, demand and supply must equal to meet our orders.

Furthermore, you might notice that this is very flat in here. The reason there is that during that time period, our customers are working off their excess inventories.

You have heard other speakers talk about working it off in the late eighties. Then you see upturn in demand when they come to us for the purchases, rather than working off internal inventories.

ANNUAL SEPARATIVE WORK PRODUCTION AND REQUIREMENTS



This is the centrifuge scenario. AVLIS, we have again the same demand curve. The diffusion production is larger. The total production is the same, because the AVLIS production is much less, just beginning in the 1993 time period.

It is fair to point out at this juncture we are going through this roughly year review for technology selection, and both advocates of centrifuge and AVLIS are relooking at these types of schedules for introduction of their technology.

So, the ones that we have assumed for this interim working scenario could be very much different than the ones that are ultimately looked at making the selection between the two technologies.

Mr. MEAD. Question: Something was said this morning—I had the impression, if you went with the AVLIS, you would have some production coming from GCEP for some short period of time before AVLIS took over.

You would not shut it down.

Mr. LONGENECKER. The statement I made this morning was that there will be production beginning in late 1985. It is now scheduled from the GCEP project. It is a rather small amount, one-half building of SET III machines, 550,000 SWU's per year.

A decision would need to be made based on the results of the May 1985 technology selection when to proceed, and you know, operate that plant, whether that would be economical from the overall enrichment enterprise point of view.

Those numbers do not include any of the AVLIS case——

Mr. **Parks**. That is correct. It assumes AVLIS is the chosen technology, that GCEP is not completed and terminated.

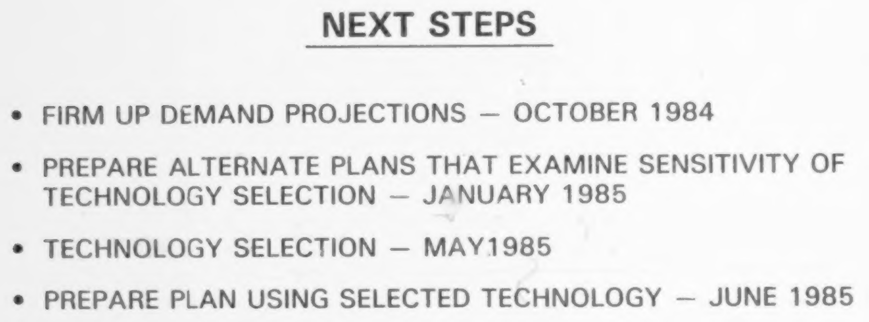
Mr. **Mead**. Just shut down.

Mr. **Parks**. That is correct. And it is in all fairness to point out we did assume for both technologies rather conservative deployment schedules.

The proponents of those technologies will likely come in with more aggressive schedules for deployment of their chosen technology, which has the effect under this demand of reducing the amount of high-cost generation of production we have to get from diffusion plants.

Mr. **Longenecker**. I should emphasize the assumption there is no GCEP production in that case is just a simplification for strategic planning. The decision of what to do with half or two or four buildings will be based on economics in the event that AVLIS is selected next May.

Mr. **Brewer**. The other conservative asssumption is that 75 percent of our customers will convert to the new contract and that all customers will take a minimum, and we have already beat that assumption.



NEXT STEPS

- FIRM UP DEMAND PROJECTIONS – OCTOBER 1984
- PREPARE ALTERNATE PLANS THAT EXAMINE SENSITIVITY OF TECHNOLOGY SELECTION – JANUARY 1985
- TECHNOLOGY SELECTION – MAY 1985
- PREPARE PLAN USING SELECTED TECHNOLOGY – JUNE 1985

Mr. **Parks**. We are very conservative in the February–April time period. Let's look at the next steps. I think that is important. October, around October we should have a firm-up of our projections and contract conversions and be able to come up with a new gigawatt forecast and come up with conversion for the new contract as well as the take. At that time, we can make another set of interim working scenarios. We have to run the sensitivity about the two technologies and somewhere in the December–January time period come out with another working scenario with two scenarios in that.

Technology selection, the schedule now for May 1985, following that we will have locked down the technology choice. We hopefully have a better feel for the demand and can prepare a plan which factors our best estimate of technology and the demand projections.

That completes my remarks.

Mr. **Lee**. Thank you. Are we later this afternoon going to focus any more sharply on the technology selection date of May 1985 than we have done to date?

Mr. **Longenecker**. We are going to do that tomorrow, Mr. Chairman. We will present at that time a description of how we are going to conduct the process as well as the relative cash flows for 1985, 1986, and a 1987 decision, and also provide, if it will be beneficial, a rough idea of the different types of information that will be available at each date.

Mr. LEE. Jeanine, in an earlier draft of our agenda there was a suggestion that Mr. Benedict, Professor Emeritus of MIT, will be testifying tomorrow. He is not on the agenda.

Ms. HULL. He is not available. However, you have his report.

Mr. LEE. Any other questions?

Proceed, please.

Mr. LONGENECKER. I would like to show one more chart that closes off the discussion on strategic planning to extrapolate to 2000. People have spoken about the assumptions of foreign supply. We can see this curve, which is based on 75–70 and includes government demand. This was done in January 1984. We assume during this time frame we see a falling off of the European orders as their contracts expire and we assume that the full 3 million SWU's of Japanese production comes into play.

One of the key asssumptions that we make in strategic planning is to make a conservative estimate for purposes of R&D and decisions to build new capacity. We also built into the contract, however, a 10-year termination provision to assure ourselves that if customers are going to leave us, it is 10 years from the termination notice until they can get out free, so we factor that into our plans.

There is a stiff penalty on a sliding scale for customers to leave us. We set a charge to accommodate for our holding reserve for customers who terminate. We do a planning horizon of 15 years, and that is done in conjunction with a U.S. contract to make sure we don't allow people to terminate in part or in whole 3 to 5 years in advance and leave us sitting here with the capital investment we have made for him. So we are contractually covered against that and we have a long range plan factoring in so some assumptions, based on our market analysis of what that demand is going to be.

Mr. POTTER. You say it is a stiff penalty for early cancellation. If I cancel in 5 years instead of 10 years, what percentage of that of my annual purchases from you?

Mr. LONGENECKER. It is a sliding scale, 10 percent a year. It is nonrecoverable costs, costs that we can say we won't charge them for but the nonavoidable costs is perhaps a better expression of that. So obviously if we don't buy power we don't incur the cost and it is not part of his termination penalty, but cost of investment and other types of overhead that we are carrying in anticipation of meeting that, would be charged to him.

Dr. BOHN. But only 50 percent?

Mr. LONGENECKER. That is correct, with 5 years advance notice, because at that time we anticipate being able to make some adjustments to be able to save the other 50 percent. So termination in zero time is 100 percent; in 1 year 90; 2 years 80. So it is a sliding scale. It gives us time to adjust our operating plan to avoid some of these overhead type costs.

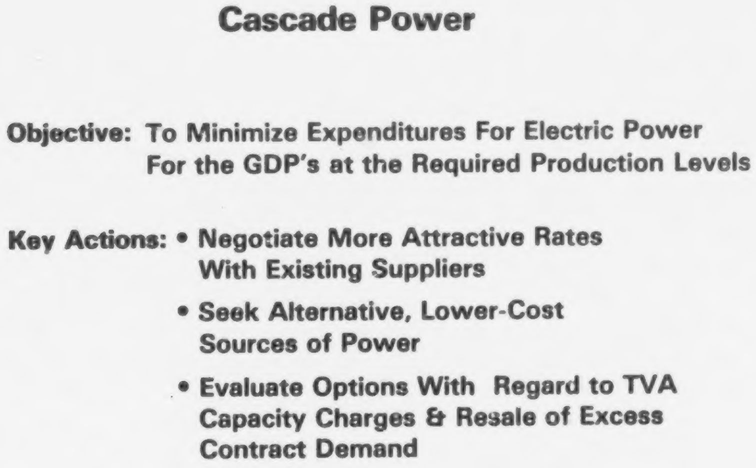
Mr. Chairman, next I would like to move on to a discussion of power supply. I mentioned this morning that that is an extremely large portion of our budget. It is 60 percent of our budget in fiscal year 1985. Our total outlays are for electric power. It is one to which we have paid a great deal of attention under the auspices of near term cost savings, because being 60 percent of our budget, even a few percent savings in that category can pay substantial benefits to us and to our customers in the form of lower prices.

We have been negotiating with all three of our power suppliers looking for alternative sources of power supply and looking at balancing the total production among the three plants to get the overall average production costs down. To assist us, we obtained the services of Bill Clagett, deputy administrator of the Western Area Power Administration in Colorado and he will describe to you our recent negotiations on power.

Mr. LEE. Mr. Clagett, glad to have you.

Mr. CLAGETT. Glad to be here.

First, I will discuss some of the parameters in which we are negotiating and towards that end, I will talk about some of the things we are doing in the negotiations, another way of saying this objective is that we are trying to minimize cost per SWU for electric power given production levels. This gives you a little more of a breakdown as to who the three power suppliers are and which plants they supply.

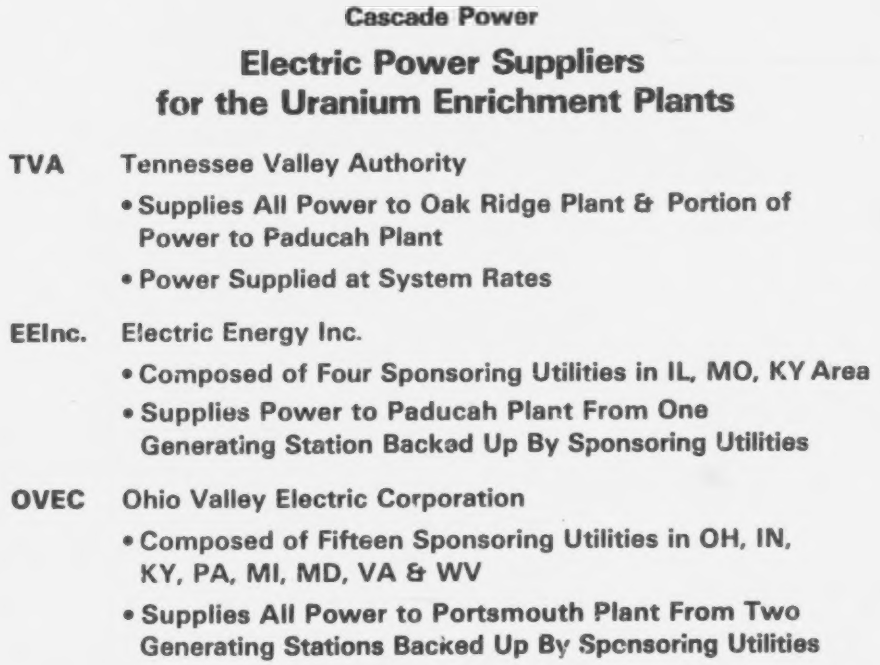


Cascade Power

Objective: To Minimize Expenditures For Electric Power For the GDP's at the Required Production Levels

Key Actions:

- Negotiate More Attractive Rates With Existing Suppliers
- Seek Alternative, Lower-Cost Sources of Power
- Evaluate Options With Regard to TVA Capacity Charges & Resale of Excess Contract Demand



Cascade Power

Electric Power Suppliers for the Uranium Enrichment Plants

TVA Tennessee Valley Authority

- Supplies All Power to Oak Ridge Plant & Portion of Power to Paducah Plant
- Power Supplied at System Rates

EEInc. Electric Energy Inc.

- Composed of Four Sponsoring Utilities in IL, MO, KY Area
- Supplies Power to Paducah Plant From One Generating Station Backed Up By Sponsoring Utilities

OVEC Ohio Valley Electric Corporation

- Composed of Fifteen Sponsoring Utilities in OH, IN, KY, PA, MI, MD, VA & WV
- Supplies All Power to Portsmouth Plant From Two Generating Stations Backed Up By Sponsoring Utilities

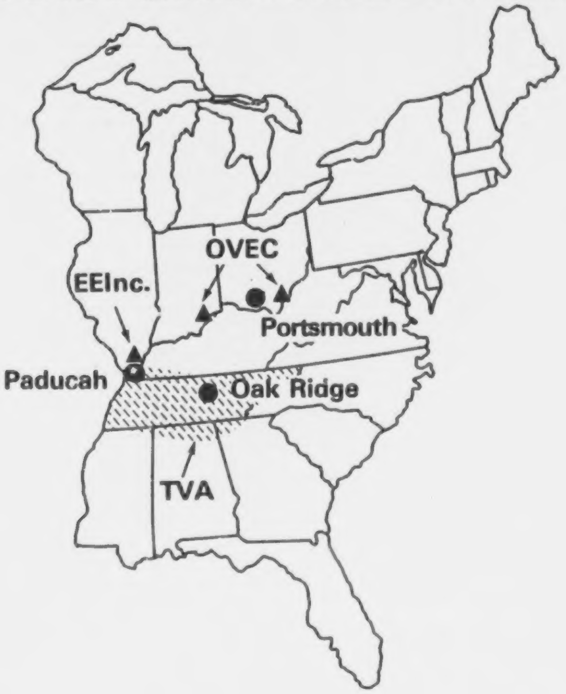
It is of interest to all of you to note that the TVA supplies more than one of the plants. It is the only one that supplies more than one, and along with that, you will find out——

Mr. MEAD. What are the percentages for the three?

Mr. CLAGETT. I have a chart in a minute that will show you exactly how much demand is available from each one. Oak Ridge is supplied by TVA only. Paducah is supplied by TVA and EEI. Portsmouth is only supplied by OVEC.

There is one other interesting difference. TVA supplies at their system wholesale rate. Both EEI and OVEC have committed powerplants so we have coal fired powerplants that were dedicated and were built originally to supply production facilities. These are some of the terms in existing contracts. I have specific demands year by year on a later chart.

Electric Supply to DOE's Uranium Enrichment Plants



Cascade Power

Uranium Enrichment Plants Key Features of Power Contracts

	TVA	EEInc	OVEC
Term	**To 6/30/95**	**To 12/30/89**	**To 10/14/92**
Maximum Contract Demand	**4485 MW**	**735 MW**	**1940 MW**
Extension Rights	**None**	**Expires 5/31/86**	**Expires 10/14/90**
Cancellation	**Up to 1000 MW/yr with 8 years notice.**	**None**	**No charge 5 years notice.**
Rates	**Industrial Rates Less 5%**	**Cost Reimbursable**	**Cost Reimbursable**

This will show the existing commitments both for DOE to these power suppliers and the power suppliers to DOE to supply. More specifically, here is a year by year breakdown of what demands were obligated to pay for each of these suppliers.

Cascade Power

Power Suppliers' Contract Obligations

(MW-Yr)

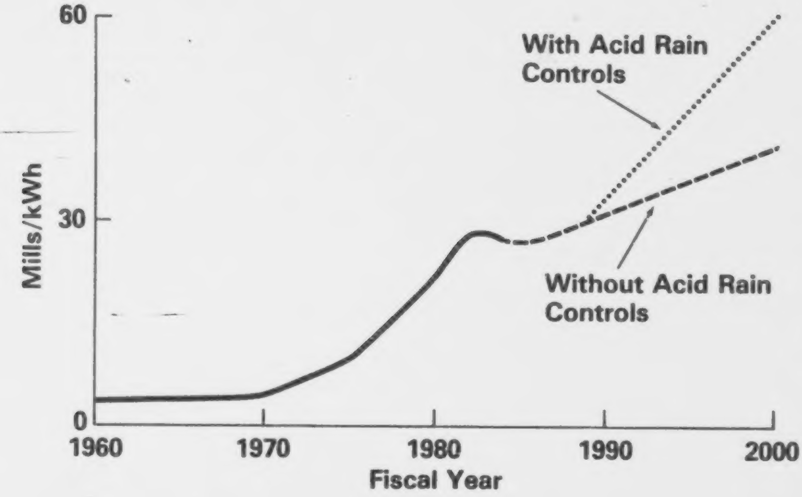
FY	TVA	EEInc.	OVEC	Total
83	3,165	123	785	4,073
84	3,786	723	1,100	5,609
85	4,485	735	1,260	6,480
86	4,485	735	1,260	6,480
87	4,485	735	1,340	6,560
88	4,485	490	1,660	6,635
89	4,485	490	1,940	6,915
90	3,715	185	1,940	5,840
91	2,715	0	1,940	4,655
92	1,715	0	1,940	3,655
93	1,485	0	74	1,559
94	1,363	0	0	1,363
95	748	0	0	748
96	0	0	0	0

One of the reasons this has all gotten critical is that up until 1970 all three suppliers were right at the four plus mills per kilowatthour level, and was between 1970 and 1980 is when the substantial increases took place. Those increases took place from all three suppliers. However, the TVA increases are the greatest.

Cascade Power

Average Annual Purchased Power Rate

- **Capacity Charges for Energy Not Purchased Excluded**



We are starting into the negotiation part of this now. It has been a long process, needless to say. I just came in, I should share with you I guess, last fall I got started, I guess, as an outsider coming from Denver. I hadn't done much in this part of the country so I have gotten a lot of geographic education.

Cascade Power

Negotiations to Eliminate Capacity Charges For Power Not Taken

- **Since March 1980 DOE Has Repeatedly Sought to Renegotiate Its Contracts With TVA to Reduce the Capacity Charges**
- **Because of TVA's Excess Capacity, TVA Has Refused to Relieve Its Customers, Including DOE, of Their Contract Demands**
- **DOE Has Exercised Its Contract Right to Cancel TVA Contract Demand; 1000 MW Effective December 24, 1989; 1000 MW Effective December 24, 1990; & 1000 MW Effective December 24, 1991**
- **DOE Has Successfully Negotiated Reductions With EEInc. For FY 81-83 & FY 88-90**
- **DOE Has Successfully Negotiated Reductions With OVEC For the FY 82-88 Time Frame**

I found that there have been considerable efforts for years to try to do something about power costs. It is because power costs have risen so much in the last few years. More specifically because of parameters you will see on a chart 2 more down, we focused first on TVA. That is in part because of the huge demand, but also because the cost of power from them is very high. It is the highest of the three by far.

Cascade Power

Summary of Negotiations With TVA

- **Latest Round of Negotiations Began in February 1984 When the Secretary Met With the TVA Board of Directors**
- **Staff Negotiations Ongoing Since March 1984**
- **Negotiations to Date Have Focused on Purchasing Power at Marginal Costs, But Have Not Involved Capacity Charge Relief or Resale of TVA Power**
- **No Progress to Date. Marginal Pricing Discussions Essentially Concluded in Early August**
- **Even If Discussions Are Successful, Little Cost Savings Will Result**
- **In July 1984 DOE Reduced Its Purchases From TVA to 650 MW (Current Contract Demand Is 4485 MW)**
- **Discussions Underway With Other Power Suppliers in an Attempt to Supplant All of the TVA Deliveries**

At the meeting, the first meeting mentioned with the Secretary and the TVA Board, one thing was split out. There has been a lot of discussion about whether or not TVA power can or should be sold outside the TVA area. There are a lot of politcal implications and also a lot of cost implications, legal implications specifically, on where TVA power can be sold directly or indirectly outside the TVA service area. That was split off and has been enjoying considerable legal review. I haven't been too much involved in that but I think it is fair to say the review continues. We focused on TVA and the possibility of buying more power from TVA. That comes down to some of the marginal costs that we had hoped TVA would have.

Out West where I come from, we find that people that have coal plants that have surplus capacity at their coal plants, especially if they are running at 30 to 45 percent of plant capacity, they are usually quite willing to give a pretty good price for a few months or few weeks or maybe even a couple of years, depending on what they forecast on a seasonal basis.

The TVA data gave the TVA the prime candidacy for a target for us to negotiate because in their annual report and data supplied outside the annual report, they have coal fuel costs ranging from slightly over 16 mills per kilowatthour up to 22 or 23 mills per kilowatt hour, but they were showing three or four of those plants that had coal costs down to 17 and 18 mills with plant factors of well under 50 percent. So we thought, well, based on our experiences elsewhere, we should be able to get power from them, or at least energy within the existing demand charges, at something considerably less than their system rate if it is a purchase or a sale for them that they would not otherwise have made, a marginal sale.

That looked like there might be money there, if we could get access on a marginal basis to some of those plants with 16 or 17 mill costs. Our experience out West is 2 to 4 mills on top of that. It is not unusual to cover the direct operating costs. You take 17 mills plus 2 to 4 mills, it looked like we might be able to talk 20 to 21 mills.

To date, we have gotten—I think that that pursuit is just about completed and I am sorry to say it has not been as successful as we would like. The last number we have from TVA—we expect another meeting, but the last meeting with TVA is yet to come. I think there is one more where it will confirm that 23 mills is about as far as they will go. The last day or two we had notice that maybe in September we can get 22 mill stuff from them but that is in short supply.

Dr. WHITTENBURY. Are TVA tough negotiators?

Mr. CLAGETT. They are the best.

Dr. WHITTENBURY. Why would they negotiate then at all?

Mr. CLAGETT. That is a good question. I am not sure I know all the reasons, but they certainly have a lot of unused capacity presumably, to sell.

Dr. WHITTENBURY. What recourse do you have to cancel the contracts or refuse to pay?

Mr. CLAGETT. They are a separate entity. They can sue for payment. They are not subject to the Department of Justice like we are.

Dr. WHITTENBURY. What would happen?

Mr. CLAGETT. They could get an injunction of some kind that would force us to continue to pay.

Dr. BOHN. If I understand the contract, you have to pay the 9.7 mills regardless of whether you use it or not?

Cascade Power

Purchased Power Unit Costs

(Mills/kWh)

	FY 84	FY 85
• TVA		
Capacity	9.7	10.8
Energy	24.8	25.6
Total	34.5	36.4
• EEInc.		
Capacity	4.5	4.8
Energy	18.0	19.0
Total	22.5	23.8
• OVEC		
Capacity	4.7	4.8
Energy	13.3	14.6
Total	18.0	19.4

Mr. CLAGETT. Yes. I have saved that chart until last because that is a good one to use to talk about.

Dr. BOHN. But it still looks as if it is cheaper to buy from either of the others even if you have to pay that 9.7 mills penalty.

Cascade Power

Capacity Charge for Power Not Purchased

(Millions of Dollars)

FY	TVA	EEInc.	OVEC	Total
81	$ 27	$—	$—	$ 27
82	111	—	—	111
83	115	—	—	115
84	227	—	—	227
85	348	—	—	348

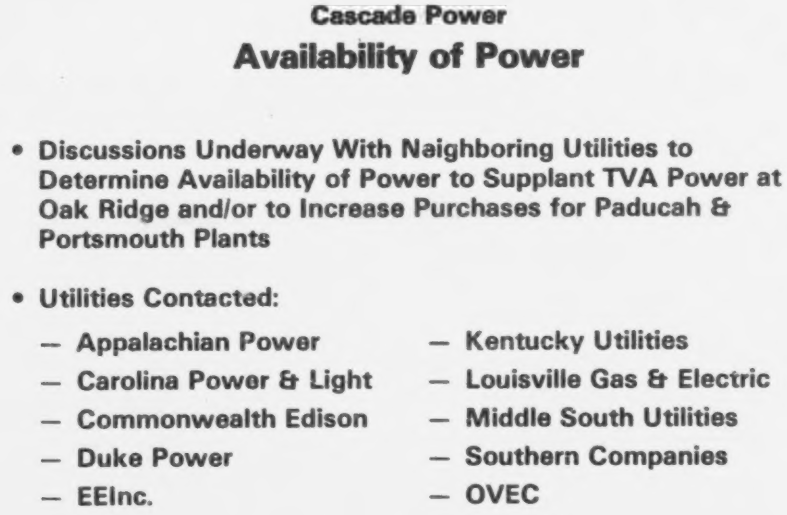
Mr. CLAGETT. That is exactly right. Here is another symptom. Here is the unused demand charges. The reason we are able to have no unused demand charges for EEI or OVEC is that their costs are so low that other people are glad to take it.

Mr. Longenecker. What you say is true. I mentioned about shifting power. July 1 of this year we dropped all TVA power from the Paducah plant and reduced down to 650 megawatts at Oak Ridge, turning it to almost its lowest operating level and increased our purchases from OVEC. That is the reality and the price of power that we see in Oak Ridge today. It is easy for another supplier to beat the energy component of that.

Mr. Clagett. The hope we had was that if we could get—because the EEI power is in Paducah and outside of the TVA service area and obviously a different supplier than the TVA and therefore not subject to the TVA restrictions, was that if we can get down under the EEI costs, the power from TVA then at those costs seems to be available at least over some foreseeable future to sell EEI power directly, and then take more power from the TVA, and that was the basic thrust.

Again, we were expecting, based on cost data, they had experience elsewhere in the country that we might get down to 18 to 20, 21 mills per kilowatthour and that would increase production and by doing that, that gets our take above the lower levels that John referred to, 650 at Oak Ridge, get above the minimum level at Paducah and perhaps Portsmouth. If we can do that, especially at TVA, we can talk about buying low-cost off season power.

One limitation that the plants have is that they can go up or down about 10 megawatts an hour. It is not one of those nice loads that can fluctuate up and down and take advantage of low cost on weekends. You can do so on weekends, but you can only go up so far. There are some opportunities for lower cost weekend power. There is some great opportunity for off season for 1, 2, 3, 4 months in the fall or the spring.



Cascade Power

Availability of Power

- Discussions Underway With Naighboring Utilities to Determine Availability of Power to Supplant TVA Power at Oak Ridge and/or to Increase Purchases for Paducah & Portsmouth Plants
- Utilities Contacted:
  - Appalachian Power
  - Carolina Power & Light
  - Commonwealth Edison
  - Duke Power
  - EEInc.
  - Kentucky Utilities
  - Louisville Gas & Electric
  - Middle South Utilities
  - Southern Companies
  - OVEC

We are now going through a survey—and I have a chart here—there are the suppliers at least that we are talking to, the important suppliers for various plants to see if we can get surpluses for a year or two or whatever to try to supplement at costs lower than these TVA energy costs. In other words, anything we can get less than the TVA, it is a lot better to buy it there and supply it than increase production with TVA.

I think that pretty well wraps it up. We are not finished with looking at selling TVA power outside TVA's area, but I don't know how much further that will go. That is obviously controversial for a lot of reasons. We are still hopeful on all fronts to try to keep the costs down for electric power. I think you saw the chart back there where we are spending, in 1985 we expect to spend in excess of $300 million for capacity to TVA that we don't now forecast a need for.

Mr. **Mead**. That is next year?

Mr. **Clagett**. Yes sir, and we are producting 10 or 11 million SWU's, that is $30 a SWU.

Dr. **Bohn**. You have looked at resale possibilities and they don't exist in that region?

Mr. **Clagett**. Within the TVA service area? TVA has an interesting program going where they have some marginal power. They offer about 100 megawatts to industries at a lower cost then their normal rates to try to get industry to start back up. They have pretty well looked over the market. They have a lot of excess capacity that they would like to sell.

Dr. **Bohn**. And they will undercut you?

Mr. **Clagett**. They have the transmission system and have access to those customers. They are already their customers. They are the supplying utility. It would be very difficult for us to even consider that market.

Mr. **Mead**. They won't offer you a lower price to sell you more?

Mr. **Clagett**. No.

Mr. **Lee**. Bill, I guess this is as good a time as any. You have been contacting a number of other utilities on your list there, and Duke Power is one of those, and we have within the week notified DOE that we would be willing to sell DOE off peak energy for the next 13 months in amounts from 0 to 650 megawatts, an estimated 40 percent of the hours over the next 13 months at 18 mills at Duke Power's border. That power would go through the Southern Co. and TVA to Oak Ridge. I have met with top executives of the Southern Co. and of TVA and advised them of that.

Mr. **Clagett**. We advised TVA also.

Mr. **Lee**. And they are both looking at their shipping costs and loses over their lines, and also looking to see if they can beat it, and if they can, it would suit every utility on the list fine, including Duke Power, because we are all DOE's customers and reduction of 1 mill for each 100 megawatt would reduce our SWU cost by 10 cents.

Mr. **Potter**. Bill, I think it is worthwhile emphasing that in the time frames we are talking about here with the new capacity and that kind of thing, that this problem you are describing evaporates, that 4,485 megawatts of contract power, and on another page it describes where 3,000 of those will be dropped in years 1989, 1990 and 1991.

Mr. **Clagett**. In 5 or 6 or 7 years, depending on where you want to draw the line, what production levels are, yes, I have to agree. Except that between now and then, $300 to $350 million a year plus any rate increases that TVA has, that is $1.5 billion plus on the cost of the SWU's produced during that period. So we think it is a fairly large problem. We are trying to do everything we can to get those costs down during that period.

Now, as far as eliminating those demand charges, we have pretty well concluded that TVA has a very tight contract, as far as we are concerned, of trying to not pay let's say those demand charges. That just merely, as TVA has said, that shifts the burden of those costs on to other rate payers that TVA has and that is awfully difficult for us to do.

Mr. **Potter**. But in terms of the big picture strategy problem solving, your problem is a short term one?

Mr. **Clagett**. I am sure that is true. Of course, when you talk 10-year plans that are going to be redone every year, production levels to the year 2000, sure, but 1½ to 2 billion dollars carried by the people who buy DOE SWU's over the next few years is a burden worth noting.

Mr. **Longenecker**. If you balance that as to what it could mean to us. Look at it two ways. If you could eliminate the demand charge by some future agreement with TVA and we could drop our price $20 per SWU it would have a tremendous impact on our consumers, tremendous benefit to them.

Alternatively, with that amount of money, that would be nearly enough in some instances to add the new increment of advanced technology. That is a dramatic price reduction to all the customers, almost enough funds to build a new plant or demand for energy. It is a very dramatic factor in the next 10 years in our competitiveness.

Mr. **Potter**. But a lot of what is driving the capital expenditures in your enterprise is the need to cut costs and you talk about one technology that is not on stream for a good number of years, by which time this particular problem that we just spoke about will have evaporated.

Mr. **Lee**. Will have been very much reduced by the demand charge. All these numbers we are looking at are in constant dollars, right, and what the energy cost is in 1990 to 2000, we don't know, but it may be higher and the advanced technologies will use 5 percent or less of the energy shown.

Mr. **Potter**. Well, there are certainly tradeoffs and there are certainly—there is certainly a form of risk that you are referring to about prices and resources, but there is also a great deal of risk when you embark on a multibillion capital expenditure program that is expected to contribute in a meaningful way some 10 years from now.

Mr. **Longenecker**. It is a big target to shoot at. We will continue working on it. I understand what you say and cannot disagree. Obviously, in the long term, we will be pleased to have either of the new technologies prove to be economically beneficial and not to need that much power or be forced to make those kind of planning projections as long as it takes to secure sources of like supply of the magnitude it takes to run gaseous diffusion plants.

Mr. Chairman, that completes the presentations except for a summary that I wanted to give on the basic strategic decisions. Since I note on the agenda, the next two speakers that you have I don't believe are here today, I will give you the option of our proceeding further down the agenda and perhaps giving you an overview of the technology or alternatively my doing a wrap-up and then we return in the morning and start with that first thing.

Mr. LEE. They are here from the General Accounting Office. I think we would next like to hear from the General Accounting Office.

Mr. LONGENECKER. OK. I have one more point on our agenda. I wanted to wrap up based on what you heard today, all the strategic decisions that we have to make. As you have heard from today's presentations, the uranium enrichment market is changing and we are trying to give you the message we are by necessity responding to the changes in the marketplace.

Our objective is to compete both on price and on services to our customers. We do not have as an intent to return to a position of being a monopoly or to eliminate competition but to respond to the needs of our customer and that is the purest sense of competition to us.

Competition is the cornerstone of the free enterprise system and the cornerstone of our stategy for enrichment. The strategy is simple. If we respond to the needs of the customers, we have got a reasonable price and good terms and a secure source of supply, we are going to capture more of the market. So that, in its purest form, is our strategy.

When we talk about what else can we do besides what we are doing today to compete, that is a basic strategic decision that we have to make and it is one that we will be studying. You heard from the SWU brokers this morning. They termed it marginal pricing. We call it incentive pricing for our customers. If we can get increased sales volume from our customers that would not be available to anyone who is not a customer of ours today, if we can get increased sales volume from our customers, we would have the potential for offering that increment of increased sales at a cost lower than the base U.S. price while still meeting the requirement of cost recovery.

It is just the simple fact that if our sales exceed our estimates in any given year, the cost to us of providing that additional volume of material is lower and it is again the purest sense of marginal price. How we would distribute that among customers and make it available and attractive to them we are evaluating, but it is clear to us that by the time we have signed all of our customers that there will still be up to 30 percent of the market out there that will be seeking a secure source of supply at a low price.

What that means to our customers, if we were to offer an incentive price, would be lowering their average price. So a customer who had agreed to take 70 percent, in a given year, if he decided that he wanted to take 100 percent that additional increment would be available to him at a price which would be lower than the base price, but it is an incentive price not a marginal price because we would offer the benefit to all the customers.

So the 100-percent customers would get a discount, hypothetically, on the amount of product over the threshold and first priority for supply. Other customers under the hypothetical scenario could get additional material provided we had capacity at a reduced price as well. So it is an incentive price for both sets of customers, not a marginal price and we are evaluating whether and how to offer that, but it is clearly under the principal of cost recovery, a way for us to return the benefits of higher volume to all of our customers.

We will look at other means as to how we can compete. How we can better serve our customers and lower the price of electric power to the ratepayers is something that we are going to be evaluating on a continuing basis. We believe that within the confines of good business practice and good judgment we are certain we can lower the real price of separative work in the near and long term by the near term control of costs, getting the operating costs down for the gaseous diffusion plants, minimizing the overall cost of power, making careful judgments on how much R&D we do and making sure that that is balanced to the long-term demand we see out there and making very tough economic decisons on when and whether to build any new enrichment capacity.

We believe that near term control of costs and by the timely introduction of new technology, I stress timely introduction—you introduce in a way that lowers cost—that we can have the real price of enrichment services declining in the future. Key strategic decisions both from what you have heard today and what you will be hearing tomorrow, I reiterate, have to lock in on our overall demand.

A U.S. contract will allow us to do that. We have to decide how to meet that demand at the least cost. We have to decide of the three technologies what is the schedule for transitioning from gaseous diffusion to advanced technologies and crucial to that is in May 1985 do we rely on AGC or AVLIS.

The underlying threat of this is how in doing that do we encourage maximum private sector participation in the enterprise. The key to all that is careful cost control and underlying and understanding all of those elements are the existing technologies. There are three in competition, gaseous diffusion competing with gas centrifuge competing with AVLIS.

It is a strong cooperative effort in developing those. Tomorrow we would like to give the technologies and describe the cooperative effort between the Government and the private sector to develop the gas centrifuge and AVLIS technologies for possible future deployment. Thank you very much.

Mr. LEE. Thank you, John.

Mr. MEAD. Are you going to discuss at all at any point here the economic tradeoffs of shutting down one of the present gaseous diffusion plants and running your capacity in the other one?

Mr. LONGENECKER. We can treat that tomorrow. We can treat it in a very general sense for you. It is highly dependent on cost of power and overhead costs and demand.

Those are the elements. And so we can define how each of those relates one to another. We have not picked a specific scenario that we could say in this instance if you shut down this one of the three plants you could save $50 million per year, but we can show you the basic elments of that.

I didn't want to mislead you to think that we had done an analysis and had before us a decision package on which of the plants to shut down.

Mr. **Lee**. What is your timetable for addressing that "whether or not" decision.

Mr. **Longenecker**. We must make that based on the demand we get from the contract this fall and be describing that to the Congress.

Dr. **Bohn**. Let me be a little more specific. I don't see any scenario here under which you want to keep all three plants open.

Mr. **Longenecker**. Let me show you one. If you look at this case, you have three gaseous diffusion plants, one 12 million SWU's capacity, the other two are 8. So if I shut 1 down I have 20 and you have appreciable production coming in from GCEP until this timeframe here, the early nineties. Depending on the response we get to the contract and what this curve rises to be, in certain scenarios with high percentage of customer retention and high sales and high military requirements, we could potentially in the 1990 to 1991 timeframe, exceed the capacity of two plants.

There are alternatives to that: Preproduction from the plants or acceleration of the advanced technologies, but there are also a number of scenarios that would indicate to you that you would need to keep three plants operating beyond the immediate timeframe.

So there are real operating scenarioes which would not allow you to shut one down.

Mr. **Mead**. There is no practical alternative to shut one down for 5 years and reopen it?

Mr. **Longenecker**. We don't think that is a practical alternative—to put into hot standby, has a rather high holding cost and we have serious reservations about the viability of a plant that has been mothballed for 5 years.

Dr. **Whittenbury**. What is the area under the curve there, 20 million—that is about four times two, about 10 million SWU's.

Mr. **Longenecker**. Yes.

Dr. **Whittenbury**. So that is a shortfall?

Mr. **Longenecker**. Yes; this is a 75 percent—70 case.

Mr. **Mead**. You could easily cover that with preproduction.

Mr. **Longenecker**. Yes. To everyone of these scenarios that would show that you need three. There is another list for possibilities of eliminating one of the plants. Each has economic and technical penalties and that is the assessment we have to go through. The one thing that we are missing is what the demand curve is.

We have all the other parameters, but we do not have a firm demand projection.

Mr. **Mead**. Well, that is going to keep changing.

Mr. **Lee**. You should have a better handle on it when you finish this round of contracts?

Mr. **Longenecker**. Yes. We get that information in November and put that into our formula and in early 1985 we have the results of that. But there are costs involved in all of those. As I say, if the optimum economic solution turns out to be next year to close down one of the gaseous diffusion plants, we will be making that recommendation but it is not a given that at this time we could or would shut one down immediately.

Mr. **Potter**. I would like to ask a broader question of Mr. Brewer. When Mr. Wolcott spoke he made a distinction concerning the objectives the enterprise can be run to meet and in my words pointed out that there could be a conflict between running it as a business or running it as a Government service.

When you run into a decision where these objectives conflict, which side do you tend to lean to?

Mr. **Brewer**. Our inclination is to run this enterprise like a business. As I said in my opening statement earlier today, the problem that we are facing now is—had its origins in the seventies when it was not run like a business. It was run, as John said, it was technically driven.

It was driven by a great deal of wishful thinking, a great deal of—I will say the word—technical chauvinism. It was driven by forecasts which were at least an order of magnitude too high. We developed a huge overhang, a fixed mortgage, and it is with the exchange rate flip-flopping in the early eighties it has begun to eat our lunch.

Now we have got to bring this back to the way it would be conducted as a private sector enterprise. There are indeed other objectives. It serves an objective in foreign policy. In my view, that is of secondary importance than serving our domestic and foreign customers and producing the lowest cost SWU and the most stable price that we can.

Mr. **Lee**. Are there other questions from the panel? We thank you, Secretary Brewer, very much. Will you be here tomorrow?

Mr. **Brewer**. Yes, sir, I will be here tomorrow and you look mighty good up there, Mr. Chairman. Why don't you run for Congress?

Mr. **Lee**. I will tell you, it is a switch to be on this side of the table. It gives you a different feeling.

Thank you, John.

We welcome our visitors from the General Accounting Office. Good afternoon, gentlemen.

STATEMENTS OF F. KEVIN BOLAND AND THOMAS MELLOY, GENERAL ACCOUNTING OFFICE

Mr. **Boland**. Good afternoon, Mr. Chairman, members of the panel. Let me introduce myself and my colleague here. I am Kevin Boland, the senior associate director with GAO in the Resources Community and Economic Development Division. That part of GAO is responsible for the energy work that is done including the uranium enrichment issue that you are discussing today and tomorrow.

With me is Tom Melloy, who is a group director. He is most directly responsible for over a long period of years for the work we have done in the uranium enrichment area. We are pleased to be here this afternoon and I have a relatively short statement that could be helpful to set the perspective for any questions you may have.

Over the years, we have made a number of reviews in the uranium enrichment program, and some of these over the last several months.

Our most recent reports address several issues which the panel would like to consider as part of its efforts. Before discussing these issues, I would like to urge the panel to view them within the context of the fundamental problems which have developed over the last several years for the uranium enrichment program, and I am sure you have heard about some of those problems today.

The market environment in which DOE's program must operate today is considerably different than the one existing during the earlier years following the program's inception.

Lower prospects for growth in the nuclear power industry, coupled with foreign competition and the emergence of a secondary market for enriched uranium are all affecting the program. With prices in the past few years the highest in the world, the program's competitive position has been steadily deteriorating.

Our recent work indicates that some of DOE's initiatives to cope with this situation and stem any further deterioration in the program may conflict with the enrichment program's cost recovery requirement.

Consequently, as stated in some of our recent reports and in congressional testimony, we believe the executive branch and the Congress together will need to reexamine the fundamental purpose and structure of the uranium enrichment program.

Such reexamination must consider our Nation's objective for serving the domestic and international uranium enrichment markets and provide adequate flexibility in pricing policies to allow effective competition with foreign suppliers.

Now, a few additional comments on pricing DOE's enrichment services and the changing market environment.

Since 1969, the U.S. Government has been providing services to enrich privately owned uranium furnished by domestic and foreign utilities.

At that time, and for several years thereafter, our Government was the only free world provider of these services. Legislative requirement then in existence stated that prices for enrichment services should provide reasonable compensation to the Government.

The term "reasonable compensation", however, was quickly challenged. During 1969 and 1970, there was considerable congressional debate over whether the term meant that the Government's prices could be set to recover more than cost.

The Congress, through the sponsorship of the former Joint Committee on Atomic Energy, determined that enrichment prices should not result in a profit. Thus, in 1970, the Congress enacted section 161(v) of the Atomic Energy Act of 1954, which provides that the Government's prices for enrichment services shall be on the basis of recovering the Government's cost over a reasonable period of time.

This is generally referred to as the program's full cost recovery requirement. And I think that perspective is important to keep in mind when we discuss some of the accounting modifications and full cost recovery issues that we have commented on in reports and recent testimony.

Let me discuss the cost recovery under DOE's new enrichment services contract.

As you know, on January 18, 1984, DOE offered its existing and prospective customers a new type of enrichment contract which it believes will enable it to help stem the continual decline in its share of the worldwide enrichment market.

The new contract, called the utilities services contract, contains a number of provisions which differ from those currently available to DOE customers.

While we have not made an in-depth examination of this contract, we have commented on one of its provisions, a guaranteed 10 year, $135 per separative work unit selling price adjusted, annually for power cost increases and inflation.

During March 1, 1984, hearings before the House Subcommittee on Energy Conservation and Power, we stated our belief that the ceiling price could hinder DOE's ability to satisfy the program's requirement for recovering its enrichment cost over a reasonable period of time.

We noted at that time DOE had been unable to provide us with an explanation as to how the $135 per separative work unit ceiling price will permit recovery of its costs and that current program costs had been running substantially higher than this figure.

Data furnished in the report we issued this past April [1] show for fiscal years 1981, 1982, and 1983, total program cost averaged more than $180 per separative work unit.

DOE has indicated that it is pursuing operating changes and accounting modifications which will permit it to overcome anticipated shortfalls in revenues and also reduce the cost charged to the enrichment program.

Briefly, to discuss some of the operating changes, DOE anticipates a decrease in 1985 enrichment revenues of more than 400 million from 1984. To cope with this situation, and to keep revenues and expenses reasonably in balance, DOE is looking at several changes which could reduce its enrichment cost.

These include reducing the production levels planned for 1985, deferring all construction beyond the first two buildings of the planned eight-building centrifuge enrichment plant now under construction in Portsmouth, OH, until after fiscal year 1985, decreasing 1985 research and development pertaining to the advanced gas centrifuge and atomic vapor laser isotope separation technologies.

In the upcoming months, we will likely be looking at some of these initiatives and the extent to which they provide DOE with the possibility of long-term improvements in the program.

Now, to the accounting modifications. In addition to these operating changes, DOE is making two accounting modifications which would, in general, have the effect of reducing cost previously recovered through enrichment prices.

DOE believes that the accounting modifications allow it to stay within the contract price ceiling of $135 per separative work unit, and for the most part, still meet the program's full cost recovery requirement.

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[1] The report referred to is entitled Information on DOE's Costing and Pricing of Uranium Enrichment Services (GAO/RCED-84-156, April 25, 1984)

The modifications relate to DOE's depreciation of enrichment plant and equipment, and the method of evaluating its uranium feed inventory in calculating enrichment prices.

In the March 1 testimony and April 25 report of this year, we pointed out both changes pose questions about DOE's ability to satisfy the program's full cost recovery requirement.

DOE currently depreciates the diffusion plants using the straight-line method. This method essentially allocates the depreciation equally over the useful life of the plant and equipment.

DOE treats its yearly depreciation expenses as part of the total cost of providing enrichment services, and as such, that cost must be recovered through the enrichment price.

Of the $3.9 billion invested in these plants, $1.9 billion has been depreciated in this manner. As we pointed out in our April 25 report, of the remaining $2 billion in undepreciated assets, $1.5 billion represents the cost of improvements DOE recently made to the plants to make them more efficient for commercial customers.

Although DOE plans to continue using the straight-line method to depreciate the plants, it is now reducing the amount of depreciation cost to be recovered over the next 10 years through the enrichment price.

Now, the net effect of this change is that 60 percent of the remaining unrecovered Government investment, or about $1.2 billion plus associated imputed interest will not be recovered.

DOE contends that it is only obligated to recover appropriate depreciation, and since the plants are expected to operate at only 40 percent of their capacity over the next 10 years, only that portion of the depreciation expense should be included in the price.

Uranium feed inventory evaluation is another accounting modification. Since 1977, DOE has been valuing the feed component of its enrichment charges at the average current market price, or about $40 per pound.

With the change DOE is now valuing this feed at its acquisition cost of about $9 per pound. In our April 25 report, we stated that this situation is governed by sections 63 and 161(m) of the Atomic Energy Act of 1954 as amended, which requires sales of Government uranium feed to be based on prices that, one, provide reasonable compensation to the Government; and, two, do not discourage the development of private sources of supply.

In a 1977 report, we said to provide reasonable compensation to the Government, this material should be valued at the market price at the time it is sold. Replacing it at a later date could cost the Government considerably more than $9 per pound, and there are indications such replacement could occur in the early 1990's.

I would like to turn to several other matters we recently covered in our report to Chairman Ottinger.

The most recent work relates to the repayment of the Government's enrichment cost and audits of the program's financial statements. Concerning the repayment questions posed to us, we point out in our report that DOE is not required to make specific repayments into Treasury for the Government's cost of providing uranium enrichment services, nor is it required to have a formal plan for making such payments.

The Atomic Energy Act of 1954, as amended, however, does require DOE to recover the Government's cost of providing enrichment services. Through the end of fiscal year 1983, DOE has recovered through the prices it charges the customers for enrichment services about $12 billion of the approximately $18 billion of the Government cost, subject to this requirement.

The disposition of these amounts have been governed by language in the annual appropriations acts and not left to the discretion of program or agency officials.

These acts generally have required that such amounts be used as part of or an offset to the annual appropriations for the program.

With respect to the questions concerning audits of the programs' financial statements, we point out that to enhance the stature and quality of these statements, they should be examined annually by independent auditors in accordance with generally accepted Government auditing standards.

In accordance with these standards, the only DOE audit group considered to have organizational independence to conduct such an examination is the Office of the Inspector General.

Although the statements have been audited annually since fiscal year 1972, the DOE Inspector General has participated in just two of these, with the remainder done by internal DOE organizations not having the desired degree of organizational independence.

While the Accounting and Auditing Act of 1950 provides GAO with general statutory authority for auditing executive branch departments, we have never audited the enrichment program's financial statements.

We have recently decided, however, to undertake an examination of the program's statement for the fiscal year ending September 30, 1984. And hopefully, that audit will get underway as soon as possible.

I would just like to make a final comment concerning some work we recently have ongoing, and it responds to a May 3, 1984 request from Chairmen Dingell and Ottinger.

We are addressing several of the legal and accounting issues concerning various actions the uranium enrichment program has recently taken. In regard to the new utility services contract, we are looking at the obligations the government will incur as a result of the issuance and further execution of that contract.

Also, we are addressing whether DOE complied with the proper procedures before implementing new contract provisions, such as the $135-ceiling price and the accounting changes.

In addition to these contract issues, we are addressing whether the implementation of the two accounting changes are consistent with the enrichment programs statutory requirement that prices be established on the basis of recovery of the Government's costs over a reasonable period of time.

Along with these legal determinations, we are also assessing whether the accounting changes are within generally accepted accounting principles.

And that concludes my statement. We will be happy to respond to any questions.

Mr. Lee. Very good, Mr. Boland.

Questions from the panel?

Mr. **Potter**. Mr. Boland, the bulk of your comments went to whether or not the $135 represented cost recovery, and then you spoke about the two accounting changes.

Mr. **Boland**. Yes.

Mr. **Potter**. Your perspective in those comments, as I heard them, was whether or not these practices, if you will, pricing and accounting, met certain legal requirements.

Mr. **Boland**. That is correct.

Mr. **Potter**. You did not comment on whether they are good business practices, for example.

Mr. **Boland**. No, I did not, per se.

Mr. **Potter**. So, if the law was passed at some different time—let's just, for the purpose of argument, strictly for the purposes of argument, if the law were to lead this enterprise to make what we could all agree is a terrible business decision, your comments would here just be strictly limited to how well they complied with the law.

Mr. **Boland**. Well, I think we are looking at a couple of things. The business practice as well as the legal implications of this.

And I tried to place in perspective where we are in the program, things have changed. And while things were changing, we still have on the books full cost recovery requirement.

Now, some of the questions that we have raised concern the amount of oversight opportunity that responsible committees of the Congress should have into major changes in the uranium enrichment program.

And these involve the two accounting modifications which make it possible to stay within the $135 per separative work unit—and I am talking about those two changes which would make it possible. We are talking about a unilateral decision to arrive at contract terms that maintain a ceiling price of $135.

Those are the only things we are talking about; from a business standpoint.

While you might argue that the accounting changes have some basis in accounting theory, they also represent a major material change which in general practice requires disclosure.

And we are saying that it makes good business sense to let the Congress be aware of that, and to have some oversight role in it.

Now, is that legally required? That is an issue that we are concerned with right now. Because if that represented a criteria change under the requirements of the Atomic Energy Act of 1954, then criteria changes have to be reported to the Congress.

They have an opportunity to comment on those changes. It is not just a legal issue, although that is very much a concern of our general counsel right now.

Mr. **Lee**. I think you also are pointing out, are you not, it is a turf issue, between the Congress and the administrative branch.

Mr. **Boland**. Well, it could be, Mr. Chairman. We try to stay out of those turf issues.

Dr. **Bohn**. Let me ask you this about the $135 price. You are saying for this year and assuming the next year or two, that is far from recovering current cost. In your DOE projections, do you see that as being a serious problem over the next 10 years, say?

Mr. **Boland**. We have not made any projections. But I guess based on the projections at the time we last looked at them—and let me add to that there are many scenarios you can draw as to what given assumptions, prices and demand, cost recovery will be, and revenue generation will be.

But based on what we last looked at, I guess the base price was $161.

Mr. **Melloy**. That, I believe, was the base price calculation for 1984. I am sorry, 1985.

Mr. **Boland**. OK, now, from that, to get down to $135, you have to take into consideration two accounting modifications. One is the depreciation writeoff, which is in effect writing off 60 percent of the facilities, and the other was the uranium feed.

Now, the accounting modifications for the writeoff, the depreciation difference, accounted for about $10 per separative work unit and the uranium feed about $17. Starting on a 161 base and working off those two changes, of $27, roughly got you down to the 135.

Now, if you say those accounting modifications have some questions of substance or legality associated with them, that have to be dealt with to stay within that contract price, it becomes apparent the concerns we are dealing with here.

If those accounting modifications are necessary to stay within $135 per separative work unit, and there are some questions as to the appropriateness of the process DOE used, that has to be dealt with, and that is what our general counsel is examining right now.

And the Secretary of Energy, in response to an inquiry we sent him, has given his opinion as to the policy and legal basis he sees in decisions he has made, and we respect that, and we have that under consideration now.

And I say——

Mr. **Lee**. His response said it was legal.

Mr. **Boland**. Yes.

Mr. **Barker**. In your introduction, you mentioned with some qualifications the changing command and so forth. Is your concern over the pricing an imprudent number or the mechanism of establishing that number.

Mr. **Boland**. I guess the mechanism of establishing that number—to the extent it was legal. And again, I say we recognize that if this country is to have a viable uranium enrichment industry for national defense and other purposes, and is to compete in the world market, we have to look realistically at where we are and what has to be done to do that.

And I say that in my statement in terms of price, competition, and to maintain the viability of that industry.

At the same time, we have to face head on the fact that we have on the books and have followed the practice over the years of recovering on a full-cost basis. That is why we say the Congress and the executive branch have to deal with this problem collectively.

And this panel is very much a part of that, I would hope.

Mr. **Lee**. Mr. Boland, two or three questions on generally accepted accounting principles as opposed to the legality or the turf, OK?

Mr. **Boland**. Yes.

Mr. Lee. One; we are all familiar with the fact that we as a Nation and we as an industry, as a society, badly missed our forecast of future energy use in this country.

Without pointing fingers as to who is to blame for that, we all agree that happened.

Mr. Boland. You are absolutely right, yes, sir.

Mr. Lee. Now, in a number of cases, there have been some partially completed facilities that were under construction to meet what was at one time thought to be a demand that is no longer out there.

And those facilities were cancelled after several—well, collectively, billions of dollars worth of investment.

Is it not a generally acceptable accounting principle to simply write off those investments when their need disappears and they have to be abandoned?

Mr. Boland. I would say that is done in common practice.

Mr. Lee. With respect to the uranium inventory pricing issue, in your comment in the report dated April 25, this year, your office's comment, you mention a $9 a pound cost of U^{308}, and a $48 market price per pound of U^{308}.

Do you think there is any U^{308} in their inventory at $40? Or do you know that there is?

Mr. Boland. I will ask Mr. Melloy.

Mr. Melloy. Your question was any of that inventory burden by DOE at $40? No, it was not.

Mr. Lee. Are you aware of the current market price and the market price that has prevailed all of 1984 and 1983?

Mr. Melloy. I assume it is in the $39 to $40 range.

Mr. Lee. There are spot transactions today at 17, and the market has been 25 or less for more than 2 years.

Now, are you aware of this generally accepted——

Mr. Boland. Would you excuse me? Are you suggesting that if it is not $40, then it should be $17?

Mr. Lee. $17 to $25.

Mr. Boland. I guess the only point I would like to make, we used $40 because at the time that was the price that we saw. The only point we have made, I guess back in our 1977 report, that the Government was required to recover a reasonable cost, reasonable price for this, which was the market price.

And that is what we are pegging that price at. If it is $17 or $20 now, I guess that would be a reasonable price.

Mr. Lee. Let's look at a general accounting—generally accepted accounting principle in connection with that. You are aware, of course, that there are energy companies that have large quantities of uranium in inventory.

Mr. Boland. Yes, sir.

Mr. Lee. Or coal in inventory.

Mr. Boland. Yes.

Mr. Lee. Specifically in the utilities case, the accounting for that inventory is a part of the rate making procedure.

Mr. Boland. Yes.

Mr. Lee. Are you aware of any State or any jurisdiction anywhere that lets the utility charge the ultimate consumer the market price instead of the cost?

Mr. BOLAND. Let me say no. But that is only because I am not familiar with that part of the business.

Mr. LEE. Then would you agree——

Mr. BOLAND. I guess——

Mr. LEE. There is a generally accepted accounting principle that would reflect charges from inventory at cost instead of market?

Mr. BOLAND. Yes.

Mr. LEE. Now——

Mr. BOLAND. And I guess the distinction has to be made that——

Mr. LEE. We are talking about consumers, are we not?

Mr. BOLAND. Yes. But we are also talking about Government versus utilities.

Mr. LEE. That wasn't the thrust of my question. Whatever the costs are to utilities, are direct costs to their customers, which are the consumers of this country.

Mr. BOLAND. Yes, sir.

Mr. LEE. In terms of fuel.

Mr. BOLAND. Yes.

Mr. LEE. Finally, what is the denominator of this array on page 10 of your April 25, 1984, report, when you calculate the total cost per SWU? Is it the number of SWU's produced?

Mr. MELLOY. That is correct.

Mr. LEE. And the selling price in that table is based upon the number of SWU's sold?

Mr. MELLOY. That is based on published selling prices that DOE is required to publish in the Federal Register.

Mr. LEE. If the denominator in the equation leading to the total cost column there had included the withdrawals from inventory, would not those costs per SWU have been less than shown?

Mr. MELLOY. I am not sure I really understand what you are saying. You are saying if inventory withdrawals—OK. I think I understand.

Mr. LEE. What is sold is a mixture of what is produced and what is taken from inventory, is it not?

Mr. MELLOY. Yes.

Mr. LEE. So if what is taken from inventory had been included in the denominator, those costs would be less in general, because earlier production was at lower cost, right?

Mr. MELLOY. Well, those costs are current year costs reflecting each year's production divided into the costs associated with those production levels.

Mr. LEE. But then you compare that table with the next and final table in that tabulation, column, rather, in that tabulation, and suggest that, therefore, costs are higher than selling prices.

Mr. MELLOY. Current costs, that is correct. Current costs are running higher than selling prices.

Mr. LEE. But——

Mr. MELLOY. For those years.

Mr. LEE. Current costs are running higher than selling prices. But the selling price, is it not, is—what is sold is comprised of two components. One is what is produced currently and one is what is withdrawn from inventory.

Mr. MELLOY. Correct.

Mr. Lee. If you had put in another table that showed total costs including cost of inventory, and tabulated it, and compared it to selling prices, would not—your new column, would not it have shown costs including withdrawals from inventory comparable generally to the selling price?

Mr. Melloy. I don't know. I haven't worked that kind of calculation. I am not sure what it would show.

Mr. Boland. I guess the line of questioning is that if you did as you are suggesting that the total costs would be less than what is shown in this column?

Mr. Lee. Yes.

Mr. Mead. If you multiply the total cost per unit by the SWU's that it is based on, the selling price and the SWU's it is based on, would they come out with the same difference? The total costs are based on production costs only here?

Mr. Boland. Yes.

Mr. Mead. Whereas the selling price is based on total sold, which includes inventory? You have two different sets of SWU's involved here.

Mr. Boland. I guess we could run those numbers. I understand where you are coming from. But I guess——

Mr. Lee. Forty percent of all sold came from inventory. It is not produced. Because the cost production was too high, and it was cheaper from inventory. So those are wrapped together, commingled and sold at a selling price.

Mr. Boland. We would be glad to run those numbers and introduce and submit it to the panel, and comment on the difference that it would make.

The table referred to in the Tri-Committee Panel briefing appears on page 10 of our April 25, 1984, report and shows DOE's annual separative work unit production and nonproduction costs and the average annual selling prices since 1971. The table shows that in recent years the total cost of providing enrichment services has been higher than the new $135 ceiling price in DOE's new enrichment services contract and that historically costs have generally exceeded prices.

As noted by the Tri-Committee Panel Chairman during the briefing, DOE sells enriched uranium not only from what is produced in a given year but also from its enriched uranium inventories which have been produced in prior years at lower costs. Thus, the information the Chairman requested is shown in the middle and right-hand columns of the following table. To obtain the amounts for the middle column, we took the annual unit costs of goods sold as published in DOE's annual financial statements for the program and added the applicable portion of nonproduction costs. The right-hand column simply repeats the selling prices shown in our April 25 report. We have also included a left-hand column for comparison purposes which shows total cost based on units produced.

Total Costs (Production and Nonproduction)

[Per separative work unit]

Fiscal year	Based on units produced	Based on units sold	Average selling prices
1971	$34.01	$28.82	$26.71
1972	31.31	31.86	30.49
1973	31.75	31.94	32.53
1974	37.06	32.92	36.99
1975	44.17	44.79	46.36
1976	54.39	53.93	60.30
1977	61.44	59.34	68.23
1978	101.51	92.19	84.29

Total Costs (Production and Nonproduction)—Continued

[Per separative work unit]

Fiscal year	Based on units produced	Based on units sold	Average selling prices
1979	100.97	90.97	95.60
1980	138.68	123.31	120.58
1981	187.78	140.77	112.81
1982	174.65	119.40	135.39
1983	181.79	137.55	143.90

As can be seen from the table, the costs assigned to the units sold generally have been less than the annual unit costs of production. The reason for this difference in costs is DOE's use of the weighted-average cost method of valuing its enriched uranium inventory. Under this method, which is recognized by generally accepted accounting principles, DOE divides the total cost of beginning inventory plus current-year production costs by the total number of separative work units included in these two categories to arrive at an amount representing the unit cost of goods available for sale. The cost of units sold therefore is recorded by multiplying this unit cost by the number of units sold. Historically, current-year production costs generally have been higher than the costs associated with beginning inventory. Because this method combines the generally higher costs of current production with lower past production costs, some current costs are included in DOE's ending enriched uranium inventory and represent costs that are yet to be recovered. In comparing selling prices with costs based on units sold, no clearcut pattern seems to emerge, except that both have followed a somewhat uninterrupted spiral upward to the point where by fiscal year 1983, both exceed the $135 per separative work unit that DOE recently established as its ceiling charge under the new contracts.

Mr. POTTER. May I comment on the comments you made with writeoffs? First, just a technicality. In our business we would be more inclined to think of, in this instance, of $1.2 billion writeoff as a 30-percent writeoff. That is, you spent four billion, you happen to have in this instance written off half of it already, you are writing off another 30 percent. Carrying that further, we don't think of that kind of adjustment as something that would influence, or shouldn't be made so that we can set prices in the future.

But rather when we look at a company, we might say to them you haven't fully recovered—put it in the context here—you have not fully recovered your costs in past years, that—you, in fact, depreciated your plant faster than you accounted for such depreciation. So we make the adjustment, the 30-percent writeoff, and we go forward, because that is what we are going to use, and that is what the value of the asset is to us from now on.

Now, do you think that is a legitimate approach for the uranium enrichment people to take?

Mr. BOLAND. Well, I guess, in effect, you are saying that if we had been under-depreciating the assets in the past, and now there is a recognition that we have a plant that doesn't have future utilization, then there is a good basis for writing that off.

In accounting theory and in practice, I would agree. It could be a good basis for writing it off. The point I make is that that could represent—it does represent a significant departure from a 100-percent depreciation practice which had been occurring in the past, and that deserves disclosure—as to what the material effect of that would be.

There is also a legal issue there.

Mr. LEE. It is disclosed, isn't it?

Mr. BOLAND. Let me say there is a proper way to disclose that.

Mr. LEE. That is back to a legal question, or turf.

Mr. BOLAND. More than turf, Mr. Chairman.

Mr. LEE. Legal or turf.

Those two matters are beyond the expertise of this panel. We will leave that to you folks.

Mr. Boland, you are aware, are you not, why the diffusion plants were built in the first place?

Mr. BOLAND. Yes, sir.

Mr. LEE. And what was that purpose?

Mr. BOLAND. That is for national defense purposes.

Mr. LEE. Any other questions?

Dr. WHITTENBURY. Since power is a very large portion of the costs of the diffusion plants, is GAO intending to look at the reasonableness of their prices?

Mr. BOLAND. I am not aware of any.

Mr. MELLOY. You are talking about the prices TVA and other charges? No. We don't have any specific plans for doing that.

Mr. BOLAND. Let me say in this work that I advised we will be doing, we will be examining all of the facets that we should properly look at if we want to do justice to the issues. That could very well be a cost that we would look at.

Mr. LEE. Any other questions?

Well, we thank you both very much. It has been very helpful to the panel to have you come here. We appreciate it.

Mr. BOLAND. Thank you.

Mr. LEE. We just have a few more minutes of comments and questions, after which the panel intends to go into executive session with a couple of special guests.

The staff of the congressional committees have suggested that I make a few remarks from the point of view of a utility and the consumers of a utility.

As most of you know, I happen to be with Duke Power Co., which on February 6 this year became the first utility to sign DOE's new contract under which they will provide a 100 percent of our company's enrichment needs, at least through 1989, and our purchases in the fiscal year beginning October 1 will represent over 6 percent of DOE's total civilian enrichment sales.

So we have an interest in what is gong on here. But more particularly, through us, our 1.4 million customers have a very keen vested interest in both the cost and the assured supply, particularly from a domestic producer.

I believe we have had enough of the history of when the plants were built in the forties and fifties and the various changes that came along in the Atomic Energy Act, and the pricing mechanism, and the different types of contracts, and the fact that most in our Nation expected the market for enrichment services to be substantially larger than we now realize it is or will be.

From the utility point of view, we think the efforts to recognize the combination of rising costs and decreasing sales due to the secondary market and the direct competition seen in the market, that it was needed and overdue that DOE reevaluate its enrichment program to stop acting like a monopoly market continued to exist.

At our company we find nuclear energy is offering significant fuel cost savings over our fossil plants which are themselves among—they are good fossil plants. But enrichment services make up one-half of the direct costs of our nuclear fuel.

And we, therefore, for our customers have a keen interest that those costs be controlled and reduced.

We know European enrichment services to be available at much lower prices. We have been involved in the secondary market. But we think that DOE's recent efforts have aimed at providing an assured supply from a domestic source, at what we visualize is the lowest possible fair price, unless we can find lower power costs to deliver to their plant.

And these are the precise objectives needed at this time, but future decisions will be critical to continuing driving toward these goals.

We would like to see four major initiatives in the enrichment program toward those goals. First, the program must be administered as a business with civilian enrichment purchases treated fairly, without Government subsidies flowing its way, either from the civilian sector to the defense sector or from the defense sector or Government sector to the civilian sector, so that the consumers of the end product, electricity, pay their fuel costs and no more, no less.

Second, we think new production facilities should be selected and introduced in a timely manner, if cost effective, to replace the energy intensive diffusion plants.

While cost reduction measures can and must be taken to reduce production costs from the present diffusion plants, the new technologies may hold the real key to long-term cost reductions.

Third, we think the enrichment business ought to compete on the world market with its foreign competitors. Competition makes our company sharper, and I think should make any enterprise sharper.

And we are seeing some signs that competition is now working in the enrichment area, as I alluded to an hour or so ago—competition in supplying electricity to the DOE enrichment plants may indeed help bring down costs.

We feel that DOE's prices must decrease further if they are to compete successfully overseas in the long pull.

The fourth and final point, we think it is critical that our Nation succeed in maintaining a healthy domestic enrichment supplier.

Nuclear power is now producing some 14 percent of our Nation's electricity. It will increase somewhat, level off, and then drop as a percentage. But we simply cannot afford to be held hostage to disruptions of overseas supply for this major fraction of our electricity supply.

Finally, we believe DOE has taken the proper first steps in really revitalizing the enrichment program. We applaud their initiative. Their market had to be stabilized. And the utilities service contract we think is an excellent vehicle to start in this direction.

A cornerstone is the price ceiling protection. And we think that will be an extremely important concept for acceptance in the world market. The overseas folks are sick and tired of the United States unilaterially calling the shots and changing the prices in the overseas customers' perception whenever Uncle Sam wants to.

Worldwide competitiveness, we think, would be enhanced by that capped price. We believe DOE has ample opportunities for future program adjustments to achieve prices even lower than the contract ceiling.

I think the contract ceiling is more important to overseas customers than perhaps it is to domestic customers who tend to trust our Government more.

We think DOE has just started on the road towards accomplishing the goals, and we at Duke would welcome the opportunity to work further with DOE and with the Congress or congressional staff in any effort such as this panel to help provide assistance and guidance.

Finally, again, my bias or prejudice is in the role of representing those consumers, because when you come right down to it, if the costs were higher, I would have to charge the consumers exactly the higher cost. But in their interest, I am interested in the cost being lower, stable, and an assured supply.

Does the panel have any questions of me about what I have said?

Mr. MEAD. Speaking as a consumer, I agree with you.

Dr. WHITTENBURY. Are you prepared to invest in this program?

Mr. LEE. I might. I think we will talk about privatization tomorrow.

Mr. POTTER. You say enrichment is about half of the fuel cost.

Mr. LEE. Of the direct cost of fuel other than the time value of money.

Mr. POTTER. Can you quantify that in terms of a certain amount per kilowatthour?

Mr. LEE. Yes. Our nuclear fuel costs us about a half cent kilowatthour including the time value of money and our coal costs us 1.9 cents per kilowatthour, including the time value of our coal inventory.

That is under generally accepted accounting principles. It is about four-to-one direct out-of-pocket fuel costs for coal.

Dr. BOHN. Is your source of uranium itself affected by where the enrichment is from?

Mr. LEE. No. Uranium is a fungible commodity.

Dr. BOHN. And similarly at the downstream end after the enrichment?

Mr. LEE. Yes, that is not affected by where the enrichment is done. As we heard earlier, Australia wanted to vertically integrate its uranium business but there are special deals that have been offered from time to time on the market, packaging uranium plus conversion, packaging uranium plus conversion plus enrichment.

You guys let me off mighty light.

Dr. BOHN. Wait until tomorrow.

Mr. LEE. Any other comments the panel members would like to make with respect to our deliberations so far?

Ms. HULL. I remind you you will be going into executive session.

Mr. LEE. We will go into executive session now and resume our public meeting tomorrow in this room at 9 o'clock.

[Whereupon, at 3:35 p.m., the advisory panel proceeded to other business.]

PROCEEDINGS OF THE TRI-COMMITTEE BUSINESS ADVISORY PANEL ON URANIUM ENRICHMENT

FRIDAY, AUGUST 17, 1984

House of Representatives, Committee on Science and Technology, Committee on Energy and Commerce and the Committee on Interior and Insular Affairs,

Washington, DC.

The committees met, pursuant to call, at 9 a.m., in room 2218, Rayburn Office Building, William S. Lee presiding.

Mr. Lee. Good morning. Before we begin the details of our agenda this morning, the panel would like to recognize Mr. Mark Miller of the staff of the Interior Committee. We heard from three of the committees that appointed this panel yesterday.

Mr. Miller, we are glad to have you, sir.

Mr. Miller. On behalf of Chairman Udall and Congressman Seiberling, I would like to welcome you on behalf of the Interior Committee. We thank you very much for volunteering your time to come in these 2 days to look at the Uranium Enrichment Program.

The Interior Committee, of course, is one of the three committees with joint jurisdiction over this program. I would like to say that the Interior Committee in a report prepared last spring for legislation reauthorizing the Department of Energy programs under its jurisdiction has come out and supports the administration's program, as well as supporting the schedule for providing uranium enrichment capacity.

I thought you might want to be aware of that. The Interior Committee was supporting this program.

Mr. Lee. Thank you, Mr. Miller.

We will call on John Longenecker of the Department of Energy. John.

Mr. Longenecker. Good morning, Mr. Chairman. Today's agenda will cover the technologies that we have available to us for production. We will cover gaseous diffusion technology, gas centrifuge, and AVLIS technology. However, before jumping into that, I would like to address a question you asked yesterday.

That is the relative differences between AGC and AVLIS in fiscal year 1985 versus fiscal year 1986 versus 1987. I would like to provide just a brief overview of the quantitative differences between that and allow you and members of the panel to use that to focus your questions on the presenters.

FY 87 Decision Budget

($ Million BA)

	84	85	86	87	88	89	90
AGC	$ 86.3	$ 96.4	$101.1	$ 85.7	$ 68.0	$ 45.3	$ 16.5
AVLIS*	103.0	101.8	127.9	221.3	322.4	363.3	358.7
Total	$189.3	$198.2	$229.0	$307.0			

*Includes Cost of Production Plant

I have got a chart for you which describes the initial funding profile that was anticipated to support a 1987 selection. This was forwarded for the first time in 1982 and it provided a funding stream through 1990 for both technologies. On the AGC line, I should point out that is only the research and development for the advanced gas centrifuge. Included in AVLIS are costs of construction design of a facility.

This assumes we would have a decision in fiscal year 1987 leading to the capability for either fast startup of an AVLIS plant or rapid deployment of the Set V machines into GCEP. You can see from the chart the relative capital intensity of the R&D program with funding in the range of $200 million per year in fiscal year 1985, increasing to slightly over $300 million by fiscal year 1987.

However, the most important part of the funding profile that is not shown there is the GCEP construction line. As I alluded to yesterday, Mr. Chairman, we were spending in the fiscal year 1983 and 1984 budget and would have continued on this profile to spend of the order of $500 to $600 million per year if we continued GCEP at that pace.

So the total money we are putting at risk to be considered in this formula would require that you add the GCEP line and associated cost impacts either with putting the project on hold while the technology selections proceed, or continuing, assuming GCEP would be completed and potentially being forced to face the fact that you had invested several billion dollars into a project which you had determined then would not be economically viable to complete or operate.

In looking at the technological basis for the decision, we have three basic decision points, 1985, 1986 and 1987, and the two options, AGC and AVLIS. And you look at a progression of test data through the years, we will have next spring, in May 1985, for AGC all of the subsystems for the centrifuge fully tested.

We will have put together subsystems and will have operated individual full scale machines at full speed.

Mr. **Lee**. You said Set V?

Mr. **Longenecker**. Yes, sir. That will lead us to the point where we can say, having tested several concepts, which of those concepts has the highest technical and economic potential. We will be in a position to select a reference design, but we will have tested a collection of Set V machines of different design concepts, with the potential of having the 600 SWU's per year production rate and will have done extensive intermediate scale testing and subsystem testing.

If we stretch that to fiscal year 1986 in that additional year, what we could do, having picked the reference design, to literally build some more machines of that reference design and do some additional high speed testing at full scale, and begin producing what we call reliability units in large enough numbers to generate statistically significant data.

In 1987, we would be at a point of having 1 year of reliability testing completed on 30 prototype Set V machines. That funding profile would require about $80 million in each of the 3 fiscal years; that is, a different program than you see here. In fact, turn that off. This now is, for a graduated program it would require about $80 million for each of those 3 fiscal years.

The AVLIS Program——

Mr. **Potter**. In addition to the numbers we have?

Mr. **Longenecker**. No; in lieu of that. In fact, let me make another chart for you, if I could.

Mr. **Lee**. What was the chart you just showed up there?

Mr. **Longenecker**. That was the origional 1987 decision. That was if you drove toward 1987 with the knowledge that you would not make it in 1985 or 1986.

Mr. **Lee**. I see.

Mr. **Longenecker**. That was funding that was required. You were concurrently constructing GCEP, designing an AVLIS plant and doing R&D on both, would have required those outlays. Now if you look at an incremental path that says I can make it either in 1985 or 1986 or 1987, that is the chart I am going to create for you here.

FUNDING

	1985	1986	1987
Advanced Gas Centrifuge	80 (72)	85	80
Atomic Vapor Laser Isotope Separation	100 (78)	100	100

I will emphasize in putting this together, these are rough estimates. You can tell by the way they are rounded off to the nearest $5 million. But they tell you the order of magnitude that would be required. You would need about $80 million for AGC and AVLIS in 1985.

If you were going to continue this program, you would need about $100 million for AVLIS in each of the 3 years. Let me make the chart, then I will explain the numbers I am showing you.

If we are going to make a 1985 decision, which is the set of numbers we gave you today, and we do that by May 1985, the 1985 number we require is lower than shown on the chart. It is here $72 million. It is here at $78 million. That is simply the basis of not having to carry the program through the full year.

If instead you make a 1986 decision, for a 1986 decision you need 80 in 1985 for AGC. You need 100 for AVLIS, again, to carry the full year.

Mr. POTTER. These are funds spent on research?

Mr. LONGENECKER. That's correct. There is a little conceptual design money in here, but primarily it is design. In 1986, then, you would need additional $85 million for AGC and $100 million to carry it through the full year. In 1987, you would need $80 to $100 million. Those numbers in sheer magnitude, you see, don't change significantly.

They are somewhat lower than you see in the chart, but they are not the primary driver in determining whether we make a technology selection. Again, underlining that there are basic differences in the way you run the program for each and different amounts of data that you would generate, the basic question is what you do in the interim with the GCEP project.

	AGC	AVLIS
85	- Subsystems fully tested - Individual full scale machines operated at high speed - Reference design selected	- Half scale separator - Single cell low laser power test
86	- Additional high speed testing - Additional full scale machine tests - Limited testing on reference design and machines and fabrication	- Half scale collector - Intermediate laser power test
87	- One year reliability testing completed on 30 prototype machines	- Full scale separator - Full laser power prototypic test

- Decision based on small scale data should be possible due to wide disparity between product cost estimates for each.
- Laser will be carried as a backup until the winner is fully demonstrated.

You have the chart in front of you. I promised I would go down the AVLIS chart, showing what you would generate with the same funding profile. For AVLIS in 1985, you have a half-scale separator operating. You will do a single cell, low-laser power test that will verify separation, economic mix, technical viability of the overall process.

By 1986, you can have again the half-scale collector and portion of the full-scale collector on-line and you will have some more laser power added so you will have an intermediate laser power test. By 1987 if you follow the profile to its completion, you will have a full-scale separator and full-laser power prototypic test.

The basic difference between 1985 and 1987 is that you do a small scale test in 1985 and make the selection between the two. If you carry it through to 1987 you will have two machines operating for a year to which to base that decision and full-scale separator and full-scale prototypic laser test for AVLIS.

The reason we believe we can make a high confidence decision, Mr. Chairman, in 1985 is primarily based on the wide disparity between the estimated product cost estimates. There is a dramatic difference between the two processes. We believe that the economic and technical assessment we are doing through the next 9 months will give us a firm basis on which to make the decision.

Obviously, the future of the enterprise depends on it, so if we don't have good data at a time or it turns out the information overlaps sufficiently, we will reconsider the advisability of making that decision. But we really believe we can. We did not, however, again, as I said before, the loser will be carried as a backup.

Mr. POTTER. At what cost?

Mr. LONGENECKER. Depends on the program. I would say $20 to $25 million per year range.

Dr. BOHN. Including the cost of keeping the Portsmouth facility going?

Mr. LONGENECKER. That is the key. As I said, those are the R&D numbers only and we focused on those. The real regret, costs to the enterprise, if you will, potentially is the carrying costs or termination restart costs for GCEP.

Dr. BOHN. Do you have a chart explaining those costs, since those seem to be much larger than the research costs?

Mr. LONGENECKER. Let me try to overview them for you. I don't have them in chart form. But if you added at the bottom a GCEP line to that chart and add the entry of $350 million for the year, that is the rough carrying costs of the GCEP project for each of those years.

Again, I would argue over the precision of the numbers. It might be $300 million in those years, but it is in that range.

Mr. LEE. In May 1985, if centrifuge is selected, then you proceed. Your plan would be to proceed with that construction?

Mr. LONGENECKER. That's correct.

Mr. LEE. If the alternative technology is selected, how fast would that line item wind down to $350 million?

Mr. LONGENECKER. There are a number of options for that, Mr. Chairman, again depending on the economics of the Set V and incremental costs of finishing either one or two or four buildings of GCEP. The decision would need to be based on those economics and decision based at that time.

Dr. BOHN. You mean if you select AVLIS you might go ahead and finish GCEP?

Mr. LONGENECKER. That might be the most economic option.

Mr. **Lee**. AVLIS won't contribute significantly to the economics for roughly 10 years.

Mr. **Longenecker**. It won't be in full production for nearly 10 years. That is correct.

Mr. **Lee**. Then there is the possiblity that some portion of GCEP may be completed or to lower products costs over the same decade. Is that right?

Mr. **Longenecker**. That is one of the potential cases.

Mr. Chairman, if I could finish the comparison we went through to why we did in 1985.

Mr. **Lee**. All right.

Mr. **Longenecker**. We had the choice in 1985 as you do in 1986 and 1987. Do you mothball GCEP and restart after the selection or do you continue it? For a 1985 selection, we anticipate that of the $350 million that you spend in 1985, about $80 million of that is Set V related. So you would do that anyway.

It has to do with the engineering and some of the support that is provided, some of the design to retrofit the Set V machines is carried under the GCEP line. About $80 million of that is Set V related and would carry through anyway. If we terminate everything accept that, that contributes to Set V which I think is Set V. The estimate is that it would cost about $250 million to terminate that and about $150 million post-May 1985 if you decided AGC was the right way to go to restart.

So the maximum exposure as stated by us in our assessment that we should continue the GCEP project pending technology selection was that total exposure to the enterprise would be of the order of $400 million, $250 million in termination and $150 million for restart and getting back down the learning curve from the centrifuge manufacturers, which they will explain to you later today.

Mr. **Lee**. I am sorry, John. I don't track that. What model are you using? May 1985 decision, AVLIS selection, in these numers?

Mr. **Longenecker**. No, sir, this was an AGC selection.

Mr. **Lee**. All right then I don't understand terminate and restart.

Mr. **Longenecker**. If we terminated rather than just paying carrying costs, we would pay $250 million to terminate the centrifuge manufacturers, our construction contracts and materials contract.

Mr. **Mead**. Set III?

Mr. **Longenecker**. Set III and construction of buildings 1 and 2 at Portsmouth.

Dr. **Bohn**. So suppose you were to go with a fiscal year 1987 decision which I understand is not your plan. It then sounds like the dominating choice would be to go through that procedure of terminating now and perhaps restarting in 1987.

Mr. **Longenecker**. That was exactly the point I was getting to; that if you stretch it to 1986 or 1987, the economics are obviously, with that calculation, if that is your maximum exposure, if it is, in fact, $400 million, 1985 decision makes sense; 1986 says that you would look very hard at mothballing GCEP for that period of time. And 1987 says that obviously you would be driven that way.

That decision and potential impacts it has both on the centrifuge industry and overall project, customers, and on the industry's perception as to whether when we begin a program, we really should have it well planned and are resolved to complete it would be significant.

We believe that we can make a technology selection in fiscal year 1985 on a high-confidence basis. We believe the cost impact of stretching it further is very high. Certainly we argue strongly for the 1985 technology selection.

Dr. BOHN. Let me see if I understand what you said about 10 minutes ago about the fiscal year selection time. You seem to be saying there was a big difference based on your preliminary knowledge as of right now, that it looks as if AVLIS is going to be significantly cheaper.

Mr. LONGENECKER. Right.

Dr. BOHN. Point two was that you were pretty confident that by May 1985 you would have fairly concrete estimates and be able to make a selection that you were quite confident of. Point three was that, if at that time you were not confident; that is, you thought AVLIS would still come out ahead but weren't sure, you would then postpone the decision. Is that correct?

Mr. LONGENECKER. There are two modifications I would make to that. The first is that we believe that if AVLIS is—excuse me. If either technology has not been able to complete its data base and we don't have a very discrete package of the technical and economic benefits of the two, we would not make a selection, obviously, with its obvious importance to the future of the enterprise. So if either one has a problem in demonstrating the data, the second modification——

The second modification I would make is that it is not our conclusion that there is a dramatic difference between the two. The advocates' estimates are different by nearly a factor of two for their production costs. We are going to verify this over the next year. If, in fact, it is true that there is that disparity, the economic choice should be reasonably clean cut. But that remains to be demonstrated.

Mr. MEAD. Do you expect to get verification of those cost differences?

Mr. LONGENECKER. Yes, sir.

Mr. MEAD. In 9 months?

Mr. LONGENECKER. Yes, sir.

Were it a 5-percent difference I might have more reservation about being able to make that call, I don't believe that is the case here. One other thing that I would emphasize that was another key point that perhaps I didn't emphasize clearly enough, the 1987 decision was a different decision than you are seeing in 1985.

The 1987 decision was a technology driven one and assumed that when we picked one, we would rapidly deploy it, you know, regardless of capacity or costs or anything else. It seemed like it would be cheap enough that we would shut down the GDP and build it. The 1985 selection is not one that is a decision to deploy. It is a decision on which of the two that we pursue and in what timeframe.

Before AVLIS or AGC would be deployed, we would need to do the reliability testing that I have laid out for you and centrifuge program. We would likely want to go to a full-scale prototype on AVLIS. The details of what we would do before deployment obviously depends on the outcome of the technological and economic questions we see and the Process Evaluation Board deliberations.

Clearly, it is a different type of decision. We believe that the underlying economics of the decision and the very high carrying costs to us, to the enterprise, to our customers, requires us to make it as early as we can.

Furthermore, we believe the data base is there to make it in fiscal year 1985. So, I hope that was a good summary. I wanted to try to differentiate between the data that are available and also the large carrying costs, continuing to carry two R&D programs and a construction program during the timeframe of the selection.

Mr. LEE. As I see, you have two major decisions. One is which type technology to go with. The other is somewhat dependent on the first. And that is, however, to build GCEP capacity.

Mr. LONGENECKER. Yes, sir.

Mr. LEE. You may build some GCEP capacity if it is the cost-effective thing to do, if AVLIS is selected. But it may be with not the most advanced machines.

Mr. LONGENECKER. That's correct.

Mr. LEE. Something simply to bring the costs down in the decade, that is cost effective, since you have already got sunk costs of $2 billion.

Mr. LONGENECKER. That's correct, yes.

Mr. LEE. Do you understand that?

Mr. MEAD. Let me ask you slightly different. If you made an AVLIS decision, which of the Set III or Set V would you cover yourself with, with GCEP?

Mr. LONGENECKER. I don't know. Let me tell you, we have looked at those options. There are proposals for getting higher output out of the Set III machine. There are also proposals for getting a low-cost Set V that does not have 600 SWU's per year production rate but perhaps 500.

My answer to that is that we would look at the options available to us and inherent costs in each, both R&D and production. If we decided to complete an increment of GCEP, we would produce the one that would give us the best economics.

Mr. LEE. Exactly. Your criteria in that case would clearly be economically driven, not technology driven?

Mr. LONGENECKER. Absolutely.

Mr. MEAD. Clearly, the AVLIS decision implies some undefined level of expenditure for AGC continuing activity.

Dr. BOHN. Put another way, if AVLIS is the technology of choice you have to factor into that choice between the two the fact that it will be available 5 years later or some number of years later. And that even if it therefore has a lower cost per SWU, when mature, it might turn out that economics are such that it was still better to go with the more quickly available technology.

Mr. LONGENECKER. That is correct. You will hear today when we describe the process selection, is that we—it is a three-part process. First, we look at the underlying technology. Then we look at the economics, absolute economics of the AVLIS and the AGC plant. Then we do an enterprise analysis that says to our overall cost base, given the difference in the time of introduction, production costs and some costs GCEP, what does that do to our price structure?

So there are differences.

Dr. BOHN. To the cost structure or your 10-year pricing or cost structure?

Mr. LONGENECKER. All of the above. If I could defer to how we would do the economic analysis, we will look at it from a number of perspectives. We do it on a cost-center basis, looking at the centrifuge and gaseous diffusion and AVLIS, all on the cost center basis and do the comparative economics. We will look at what it does to our price.

We are also evaluating whether we want to change our pricing structure and pricing formula as new technologies are introduced. That is the last part of the analysis we do. That is an overall enterprise analysis that says what are the options for deploying either of the two into the total enterprise.

But one point you raise that I would like to clarify, AVLIS is not available 5 years after AGC or GCEP. In a very strict sense, the reference we are currently evaluating, and these may be exceeded, or may have on one side or the other, but we are looking at full production of an AVLIS facility roughly, full production, roughly 2 to 3 years later than GCEP with Set V's.

That would just have to do with the time it would take if you pick Set V's to get them new production, retrofit the buildings and get them up to speed. The stark underlying economic fact that drives us to the 1985 technology selection rate we have concluded we have a good data base, the single fact is that had we continued under the old program, we would have had \$3.8 to \$4 billion sunk into the GCEP project by the time we made the selection.

We would have had quite a few Set III machines in there and this would have affected the Set V machines. The overall economic benefits are enhanced to the enterprise by our being able to make an early selection between the two. Again based on the data, over a decade of data on AVLIS and over two decades on AGC, we believe we can make that decision.

Mr. LEE. Thank you for bringing that to us this morning.

Mr. LONGENECKER. Mr. Chairman, if I can, I apologize for the very brief overview. If I could provide any additional economic information on the analysis we did, I would be glad to do that.

Mr. MEAD. It would be nice to get each of these alternatives spelled out with all its pieces so that you could add it all up.

Mr. LONGENECKER. We would be glad to provide you with data we had. Again, I apologize. Just due to the time and summary nature of this, I was concerned that if I got into this this morning we would never hear about the advanced technologies.

Mr. MEAD. That is probably true.

Mr. LEE. All right. Now the advocates of each of the advanced technologies will have some feel for their views about the costs, won't they?

Mr. LONGENECKER. Yes, sir, they will. Rather strongly held opinions, I might add.

To begin the presentation of the advanced technologies we have Clyde Hopkins, executive vice president of Martin Marietta who are involved in both the AVLIS and AGC programs to provide an overview and describe basically why it is we began and why we are continuing to develop both the AGC and AVLIS technologies.

STATEMENT OF CLYDE C. HOPKINS, VICE PRESIDENT, MARTIN MARIETTA CORP., ACCOMPANIED BY DR. ROBERT MERRIMAN, MARTIN MARIETTA CORP.

Mr. **Hopkins**. Thank you for allowing me a little time to give comments about each of the technologies you have been hearing about. I hope I can set the stage for you for the speakers that are going to follow. As John said, they have rather strong opinions and they are all rather well-founded, I might say.

You will begin to feel the same optimism we feel about the enrichment enterprise. There is no question but what the country is in good shape to stay in that business for a long while. I would like to tell you something about the transition of Martin Marietta.

As was clearly said yesterday, we are in a highly competitive situation in the world market. There is just no doubt about that. Mr. Lee, I would like to echo the position you took and the one John took this morning. We in the country should not deploy any new technology unless it is cost effective and will keep us in a good position in the world market for a long time.

We also share your opinion that the prices must continue to decrease. That has been our history in gaseous diffusion. As you know gaseous diffusion has been underway for about 40 years. When we look at what we are able to get out of a gaseous diffusion plant for a given unit of input of power, we see that that ouput is about 4½ times what it was in the early fifties.

Because of improvements in technology we have been able to bring the gaseous diffusion business to a very mature state. We think we have gotten about all of that technology into that system we are going to get. But it has been a great technology. We think it leaves DOE in a very good position here to be able to have great confidence in meeting the contractural requirements we have around the world and to be able to know with confidence that we can produce SWU's with the gaseous diffusion process at a pretty good price.

When Bob Merriman shows you some incremental cost numbers this morning, I think you will begin to sense that it is not a bad process. It has one problem, as you can see. It is energy intensive. You heard yesterday it takes 2,350 kilowatthours to make an SWU. That is unfortunate. But maybe with some of the help we heard about from Mr. Claggett and Mr. Lee, yesterday, we might be able to help the energy problem some.

As far as other costs are concerned, we have a significant effort going on in all three diffusion plants for the last 2 years, trying to reduce costs. Nate Hurt will be telling you in a moment that we decreased our forces in the three gaseous diffusion plants very significantly and decreased our overall costs in those plants very significantly in the last 2 years.

We have just begun another series of cost-reduction efforts involving all three diffusion sites where our people are getting together and really looking hard at eliminating, duplicating capabilities or technologies. For example, why do we have all three plants doing analytical work for the process? Why do we have all three plants making seals? We are taking a good hard look at that kind of thing. We believe we will be able to see further significant reductions in costs.

I should have said right up front that the reason we have been able to improve the productivity of the diffusion process, I think, over the years is because of the two outstanding technical teams we have in our company and the Goodyear Atomic Co. These two companies have worked almost as one over the 30 year period of time. It is because of that good working relationship we have been able to see the successes we have had.

Dr. WHITTENBURY. While we are on that slide, gas centrifuge, that is AGC?

Mr. HOPKINS. Right.

Dr. WHITTENBURY. As apparently they did in Europe, the way that they conserved the 2,350 kilowatthours per SWU problem, they built cheap power. Was that ever compared as an alternative to the advanced technology programs?

Mr. HOPKINS. No, not really. I will have to say—we have been tied into the TVA system and these long-term contracts so long, we have never really given that serious consideration. Really, within the last 7 or 8 years any consideration of that would not have been appropriate because of the limited life of the diffusion process.

We have known for some time we would have to have new technology because of the energy intensity of the process. As early as 1970 we came to that conclusion. The gaseous diffusion people are not counted out. We believe they are still in the game. When you see some of the numbers a little later you might also believe they are still in the game.

We know factually what that process can do. We don't have to guess at it. Moving to the gas centrifuge, you are aware this started with Dr. Jesse Beams at the University of Virginia as early as 1938, but got revived in the early 1960's. Martin Marietta, then Union Carbide, teamed up with Dr. Beams to get the process underway at Oak Ridge. In about the middle 1960's, DOE decided to bring AiResearch Corp. into the process development business and that has been a very successful program over the years.

You can see it is very energy efficient. It takes 150 kilowatthours per SWU and has great potential for improvement. You have heard already we expect to be able to improve the capacity of the machines we are looking at from 200 SWU's per year per machine to 600 SWU's per year per machine. We not only have the two development organizations working on the process for all these years, when we brought the centrifuge manufacturers in, that strengthened the program significantly.

There is a little question, no question but because we do have people in who understand manufacturing techniques a lot better than development organizations do, who are able to bring their expertise to bear on the program. When you combine their efforts, their manufacturing expertise and our process development efforts into the two organizations pursuing that activity, when you combine the two you have a team that is really able to respond much more quickly to solve problems that occur in this particular process of upgrading from 200 to 600 SWU's.

I think we have a very, very, strong team here that is going to be a competitive technology. No doubt about it. Frankly, I have very, very, high confidence that the gaseous centrifuge process can significantly beat the gaseous diffusion process in the long term in terms of cost per SWU. We have the same people. We have the same facilities who can apply what they have learned in the Set II program to the Set V.

A lot of that experience is going to extrapolate very directly up to the Set V machine. We believe because we do have such good experience on Set III, and that was clearly demonstated when the manufacturers put together 120 machines, put together a cascade about 2 years ago, built in Oak Ridge, we operated it at Martin Marietta, but the manufacturers all used production tooling to make Set III's.

That facility came on line in August 1982. We recently took it off line. It was a highly successful operation, much more successful than anybody would have expected. From the day we put it on until the day we closed it down it was onstream over 99 percent of the team.

Dr. BOHN. Why did you take it off line?

Mr. HOPKINS. Because of the economics. We had learned all we needed to learn, we felt, out of the Set III experience. It was not making SWU's at a low enough cost to keep it on line so we just closed it down.

Dr. BOHN. It was more expensive than the diffusion.

Mr. HOPKINS. Yes. Roughly comparable.

Mr. POTTER. Why is that?

Mr. HOPKINS. Because it was just a small 120 machine facility. You have to have a standard crew to operate it.

Mr. LONGENECKER. It is not being operated in a production mode.

Mr. HOPKINS. No, it was strictly experimental.

Mr. POTTER. How much was spent to build that?

Mr. HOPKINS. $60 million.

Mr. LEE. I calculate that is 24,000 SWU's per year. Is that right?

Mr. HOPKINS. Yes. But that was a highly successful experience. We are convinced because of that experience we do know how to successfully build gas centrifuge machines.

Moving to AVLIS, as you know, the Lawrence Livermore Laboratory was given the lead role for the AVLIS process. They in turn took us on, Martin Marietta, as a partner early in the game. They took us on, I think, primarily because of our long experience in handling uranium in its various forms from oxides to gases to metals.

We have had a very successful working relationship with LLL over the years. The basic responsibility, as you probably know, has been shaken down in recent years to having Livermore pursue with their staff development a laser for the technology we are going to employ in the future and we have been pursuing the separator technology at Oak Ridge. Both programs are going very very well.

When you look at the fact that AVLIS has been going really roughly about 10 years, the progress that this program has made is rather astounding, rather outstanding. We believe that progress is going to continue. As John has already mentioned, we will have demonstrated on a half scale basis out in Livermore that the separation process will work and construction of the full-scale facility is already underway.

A lot of progress for 10 years. It, too, is energy efficient and we believe like all the other processes it will have the future potential for improvement just like the other two will continue to have potential or at least the gas centrifuge will continue to have potential for the further improvements beyond the 600 SWU's.

The other thing AVLIS has in its favor is potential, as John said, for low capital costs. That will have to be sorted out over the next few months. So I guess in summary, the way we at Martin Marietta feel is we are going to continue to operate those gaseous diffusion plants and Goodyear, we are going to continue to operate those gas diffusion plants as efficiently as possible.

We believe both the new technologies can in the long run produce SWU's much more cheaply than gaseous diffusion. We have two very high quality technical teams that are going to pursue the two technologies and can and will come up with the appropriate data to allow the process evaluation board to make their decision next May.

We are confident that when that decision is made we can put in place a plant that is required to meet whatever the market says we need to meet in the way of new production. We know when it is in place that we will be able—that we will be very very competitive on the world market. We know we have a lead on the new technology. What we want to do is keep that lead so that our competitors don't ever catch up to us. We are confident we will be able to do that once the decision is made.

Mr. POTTER. Could you give the panel some idea how much has been spent just in 20 years on gas centrifuge and 10 years on AVLIS.

Mr. HOPKINS. As far as R&D is concerned I would guess we are in the neighborhood of $800 million. Somebody help me. $800 million?

Mr. POTTER. For which?

Mr. LONGENECKER. AGC.

Mr. HOPKINS. $800 million. How about AVLIS, Jim?

VOICE. $300 million including construction of the demonstration facility.

Mr. HOPKINS. $800 million versus $300 million.

Mr. LEE. John, does the $800 million R&D for centrifuge—is that included in the $2 billion sunk costs?

Mr. LONGENECKER. No, sir.

Mr. LEE. $2 billion for GCEP is in addition to $800 million?

Mr. LONGENECKER. Is in addition, that is correct. $2 billion is just the construction and design of that facility.

Mr. POTTER. Isn't that considered R&D?

Mr. LONGENECKER. Excuse me?

Mr. POTTER. That isn't considered part of your research efforts?

Mr. LONGENECKER. No, it is not. There is also a construction element. What is the total——

VOICE. The total is about $800 million.

Mr. HOPKINS. That is what I thought. Roughly, $600 million for R&D and $200 million for capital facilities in support of that R&D in gas centrifuge.

Mr. POTTER. Is much of that $2 billion salvageable if you go either way? The $2 billion for production facilities.

Mr. LONGENECKER. Meaning Set III versus Set V?

Mr. POTTER. What about AVLIS, can you use any of it for AVLIS?

Mr. LONGENECKER. Very little, is my guess. Processes are different enough. You certainly have UF_6 handling equipment, large buildings there——

Mr. MEAD. For the AGC decision that would be mostly salvageable.

Mr. LONGENECKER. Correct.

Mr. HOPKINS. Yes. You will hear a good more about costs as the program advocates come on line today. Let me say a little more about Martin Marietta.

It assumed responsibility for Oak Ridge and Paducah operations April 1. The transition was very very smooth. We have continuity of activity without any hitches at all. You can hardly tell the difference at this stage in terms of what has happened to date.

We will see a lot of differences down the pike. But obviously it has been too short a time to see great changes in the way we do business right now. At the bottom I have simply listed the activities we have been involved in and will continue to be under Martin Marietta: Operation at Oak Ridge and Paducah, support of AVLIS and gas centrifuge.

We have a large effort regarding analysis and program support for the process evaluation board and Department of Energy at all times, have strong operations analysis organization which provides information and data on which the DOE can make their decisions. Let me say a word about the commitment of Martin Marietta.

Martin Marietta's management believes uranium enrichment is important to the United States and we certainly support the DOE strategy as currently perceived. We believe that is going to put us in the best position for the country in the long run. Martin Marietta is truly committed to assisting DOE in all of its goals and objectives and we think we will be very very effective in helping them meet those goals and objectives.

I might say as far as the people who have come into our organization, they are outstanding people, they are led by a man who I think is extremely outstanding, Ken Jarmalow is our president. Along with Ken have come some dozen other people into the organization. There are a lot of ideas for improving things at Oak Ridge and I think we will see things happen that will improve business over the years.

Ken is totally committed to the enrichment enterprise. We have already begun to bring in people from corporate to help us with the business perspective of the activity that is going on in the whole enrichment business. As we get people cleared, we are bringing in their technical people to help us evaluate our program direction. You are going to see a lot more corporate involvement in activities in Oak Ridge under Martin Marietta than we ever saw under Union Carbide and we think that's great.

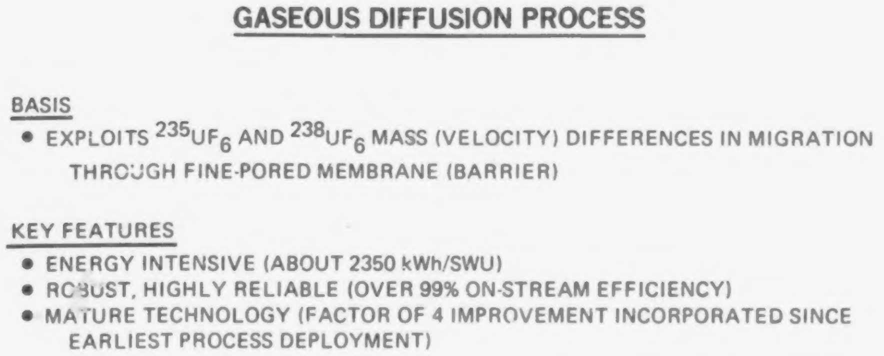
You are going to see exchanges in people. You will see more and more people come into our organization and our people going into the Martin Marietta Corp. I think that strengthens both organizations when we are able to do that. We who have been there a long time are extremely enthusiastic about having Martin Marietta there and I think we will help take the DOE where we ought to go for the benefit of the country.

Mr. **Lee**. Thank you, Clyde.

Next who do we want to hear from?

Mr. **Longenecker**. Without further adieu, we are going to tell you about our cash cow, that part of the business that generates the cash to fund R&D and construction of new capacity. Presenting that will be Bob Merriman, also of Martin Marietta.

Dr. **Merriman**. It is a real pleasure to have this opportunity to address the panel as a representative of, as John said, the cash cow of the business and explain to you something of the status of that technology and status in our production activities, particularly giving you some feel of our cost of operation and condition of the plants and objectives of some of our programs right now.



GASEOUS DIFFUSION PROCESS

BASIS
- EXPLOITS $^{235}UF_6$ AND $^{238}UF_6$ MASS (VELOCITY) DIFFERENCES IN MIGRATION THROUGH FINE-PORED MEMBRANE (BARRIER)

KEY FEATURES
- ENERGY INTENSIVE (ABOUT 2350 kWh/SWU)
- ROBUST, HIGHLY RELIABLE (OVER 99% ON-STREAM EFFICIENCY)
- MATURE TECHNOLOGY (FACTOR OF 4 IMPROVEMENT INCORPORATED SINCE EARLIEST PROCESS DEPLOYMENT)

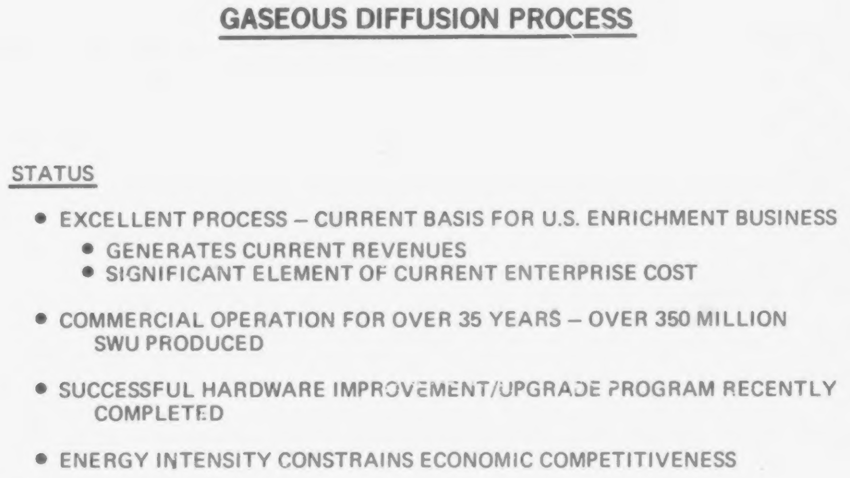
CHART M-1

The first point that I would like to make as I summarize the key gaseous diffusion process features is that the energy intensive nature of the process is derived just fundamentally from the fact that the separation depends on pumping gas through a finely pored membrane. That is a power intensive operation.

There is a small separation factor which leads to repetitive operation of that particular step. So it is the repetitive operation of these large gas pumping operations that leads to this name plate energy efficiency of 2,350 kilowatthours per SWU. Let me say that while that is the name plate, today we are operating along about 2,100 kilowatt hours per SWU.

So we do continue to squeeze a little bit out of the technology and out of the plants as we optimize their configuration. Another point that I would like to make is that the robust nature of this process has allowed us to operate it over a wide range of duty cycles and maintain an outstanding on stream efficiency of over 99 percent.

It is a mature technology. Obviously, the name of the game is to operate that complex in the most cost efficient manner to both get the costs down in the near term as well as we can and provide the right kind of target for assessing AGC and AVLIS.



GASEOUS DIFFUSION PROCESS

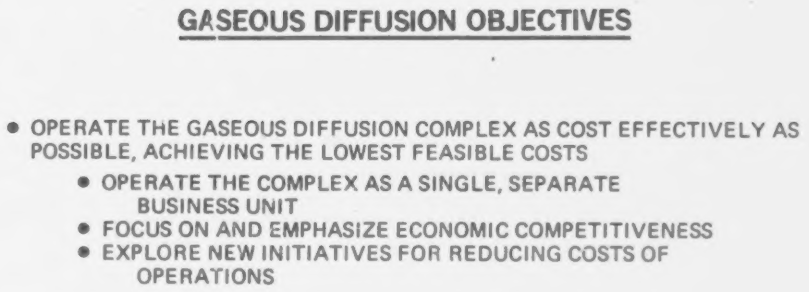
STATUS

- EXCELLENT PROCESS – CURRENT BASIS FOR U.S. ENRICHMENT BUSINESS
  - GENERATES CURRENT REVENUES
  - SIGNIFICANT ELEMENT OF CURRENT ENTERPRISE COST
- COMMERCIAL OPERATION FOR OVER 35 YEARS – OVER 350 MILLION SWU PRODUCED
- SUCCESSFUL HARDWARE IMPROVEMENT/UPGRADE PROGRAM RECENTLY COMPLETED
- ENERGY INTENSITY CONSTRAINS ECONOMIC COMPETITIVENESS

CHART M-2

While the point was made that the revenues we get today are generated by gaseous diffusion, it is also fair to say that the significant element of our cost of operation of the whole business, of course, power to the diffusion plants. I would mention later the fact that we have completed some hardware modifications and I will tell you a little more about that.

Again, the fundamental point about gaseous diffusion is that it is energy intensive. Its energy intensiveness does constrain its economic competitiveness over the long haul and provides motivation toward displacing that effectively. Where are we going right now?



GASEOUS DIFFUSION OBJECTIVES

- OPERATE THE GASEOUS DIFFUSION COMPLEX AS COST EFFECTIVELY AS POSSIBLE, ACHIEVING THE LOWEST FEASIBLE COSTS
  - OPERATE THE COMPLEX AS A SINGLE, SEPARATE BUSINESS UNIT
  - FOCUS ON AND EMPHASIZE ECONOMIC COMPETITIVENESS
  - EXPLORE NEW INITIATIVES FOR REDUCING COSTS OF OPERATIONS

CHART M-3

The objectives are to operate the three as cost effectively as possible to achieve lowest feasible costs. Despite the fact that we are two companies, as Clyde said, the exemplary cooperation that has existed between Goodyear and Union Carbide, now Martin Marietta, allows us to function as a separate business unit. We are moving further in that direction to really focus on understanding precisely what the costs are attributable to gaseous diffusion.

We are focusing on the economic competitiveness and exploring initiatives that I will summarize in a minute for reducing all of our costs of operation. I have some material in the briefing package about the history and size of the plants. In the interest of time, Mr. Chairman, unless you would like——

Mr. LEE. Let's just skip over that, Bob. Were you here yesterday?

Dr. MERRIMAN. Yes, sir.

Mr. LEE. Then you have a feel for where the panel has come to.

Dr. MERRIMAN. Yes.

Mr. LEE. So let's move right along.

GASEOUS DIFFUSION SEPARATIVE CAPACITIES

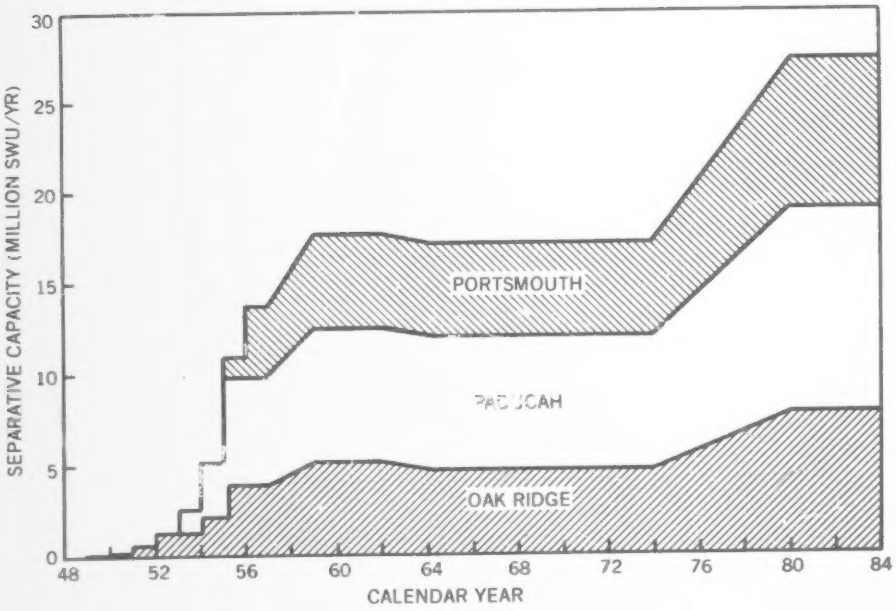


CHART M-4

Dr. **Merriman**. That is why I would move fairly quickly into the current costs. I will say that the capacity is 27 million SWU's a year. This shows how that was added—primarily in two increments, the first being in the fifties, as Mr. Lee pointed out yesterday, for military programs, then in the seventies that was expanded by about 10 million SWU's a year.

GASEOUS DIFFUSION PLANT DIFFUSER

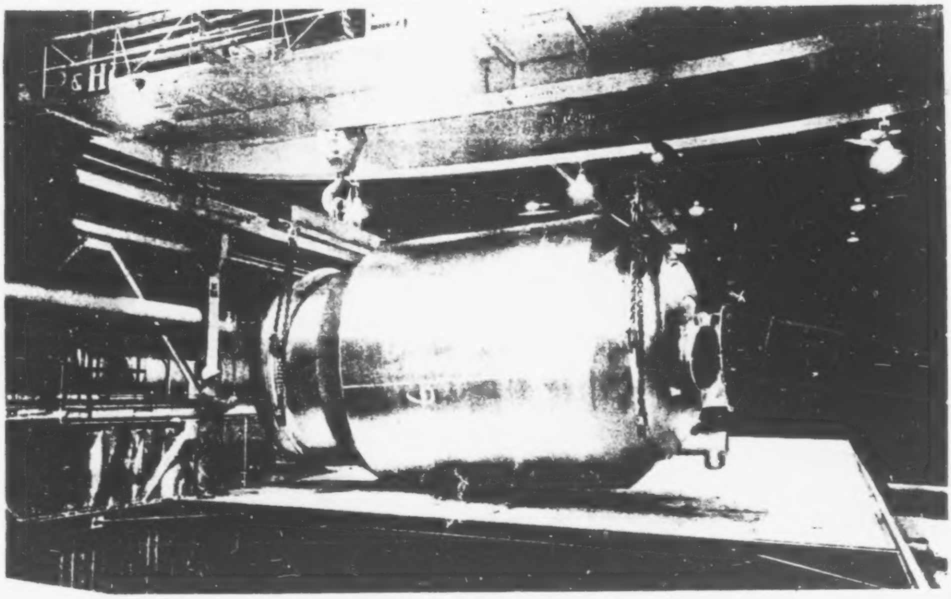


CHART M-5

I will give you just a little feel for the size of the equipment. This is one of the large diffusers which contains the membrane. It is a large industrial process. The buildings require many, many acres, but very few operations.

AXIAL FLOW GAS COMPRESSOR

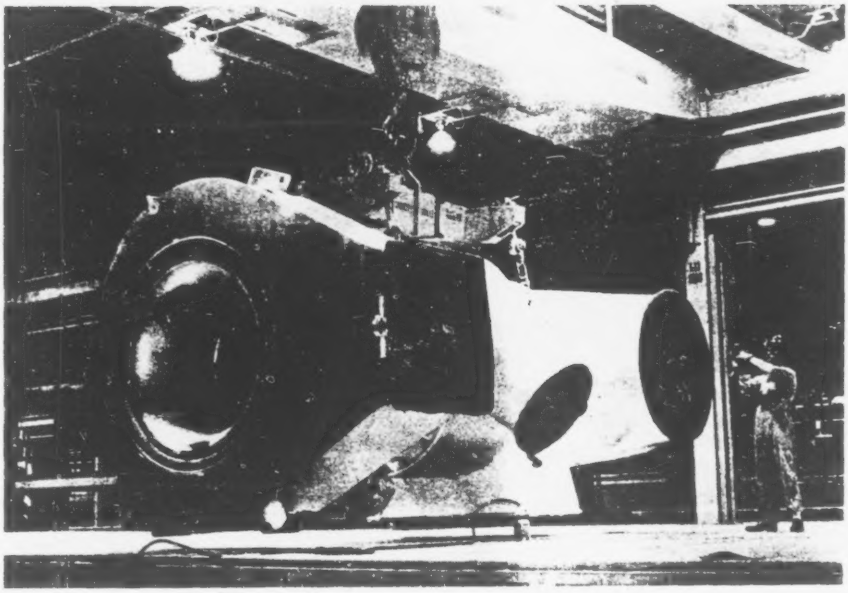


CHART M-6

This is one of the big gas compressors which in this case is equipped with a 3,300 horsepower motor. There are over 1,000 of those in the complex, which again ties back to the electric energy production or requirements.

PROGRESS OF GASEOUS DIFFUSION TECHNOLOGY

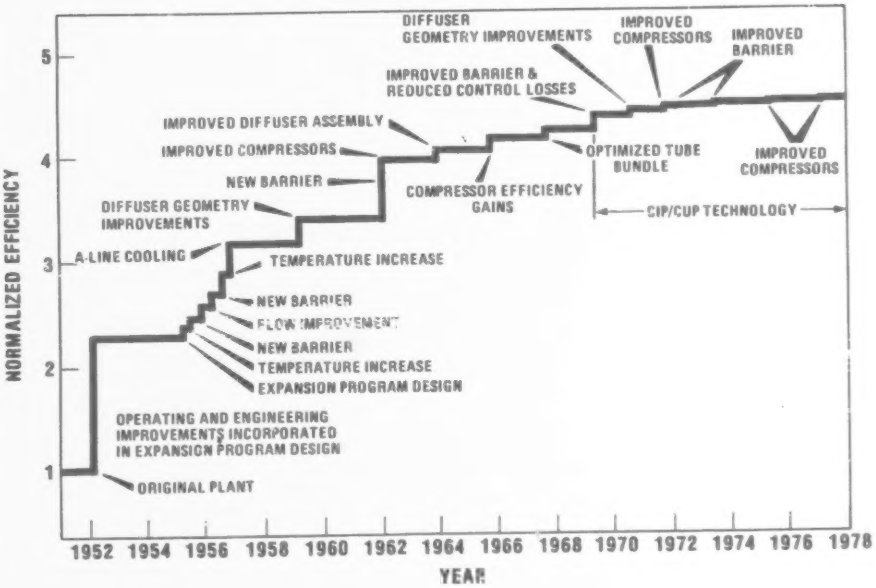


CHART M-7

I would like to move now into the principal factors, costs versus efficiency of the process and the reliability of the process. This is a fairly busy chart which summarizes the various improvements that have been made to the technology over the last few decades. You can see it is a classic learning curve.

GDP ENERGY INTENSITY

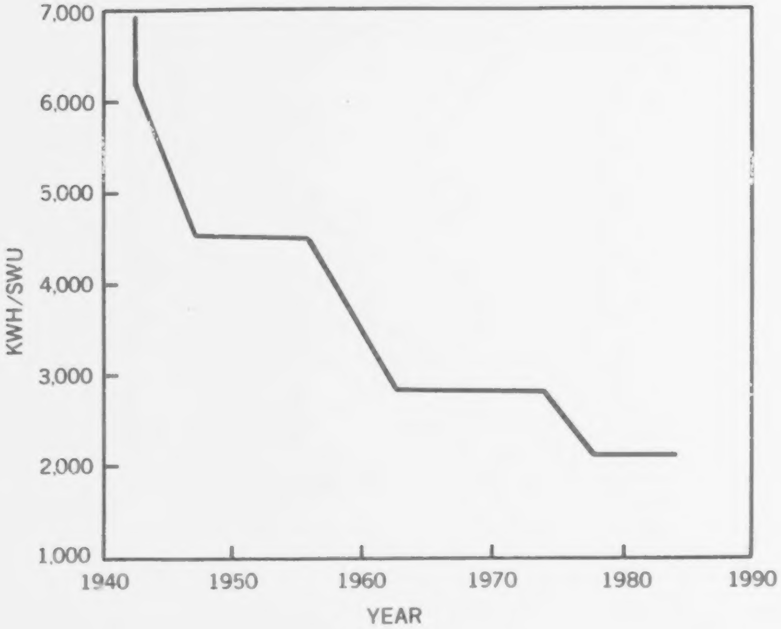


CHART M-8

We are now out on the flat part of that curve. Primarily the gains have been in the area of the membrane and gas compressors. If I summarize that a little different way and take out some of the rough spots you can see how the energy intensity has come down on well over 6,000 kilowatthours per SWU down to the level being achieved today which again in operation, is around 2,100 kilowatthours per SWU.

Mr. MEAD. The major reductions——

Dr. MERRIMAN. They came as a result of improving the membrane——

Mr. MEAD. Factor of scale?

Dr. MERRIMAN. No, it is the efficiencies, efficiency of the membrane. A change in the way the heat is removed and some compressor efficiencies. This is just a smooth-out mirror image type of chart. Let me make one comment. The size of the equipment itself was changed during the fifties. So this first jump reflected the introduction of large size equipment. Since then it has been membrane improvements, things like that.

Well, to first order, you can take the 2,100 or so kilowatthours per SWU and multiply that by whatever the dollars per kilowatt hour are to get the hours per SWU. One of the reasons for that is the highly reliable nature of the gas diffusion process. The point I will make here is that failures are rare in the process, and except for the gas seal, and for that reason, maintenance costs are very low as our direct labor costs.

GDP COMPLEX ON-STREAM EFFICIENCY RECORD

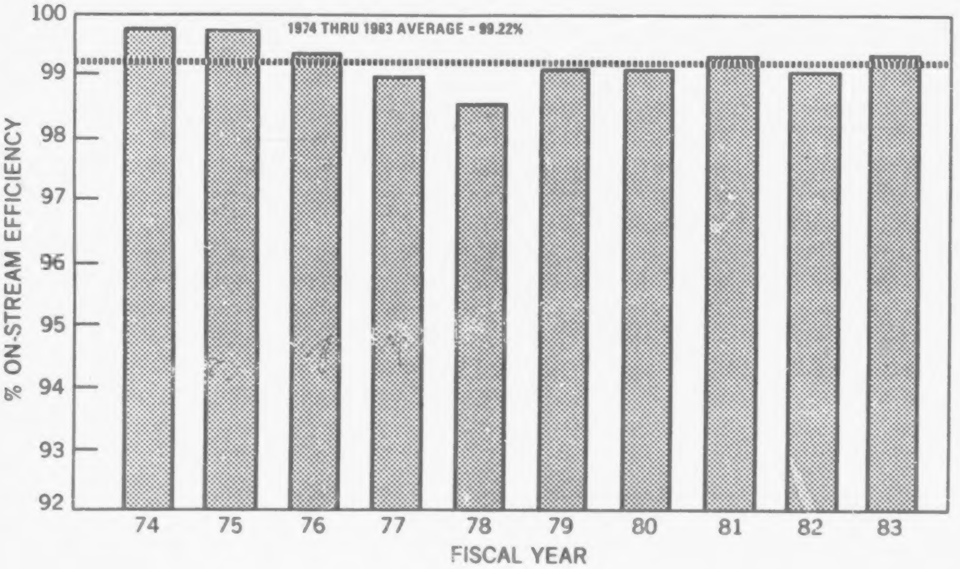
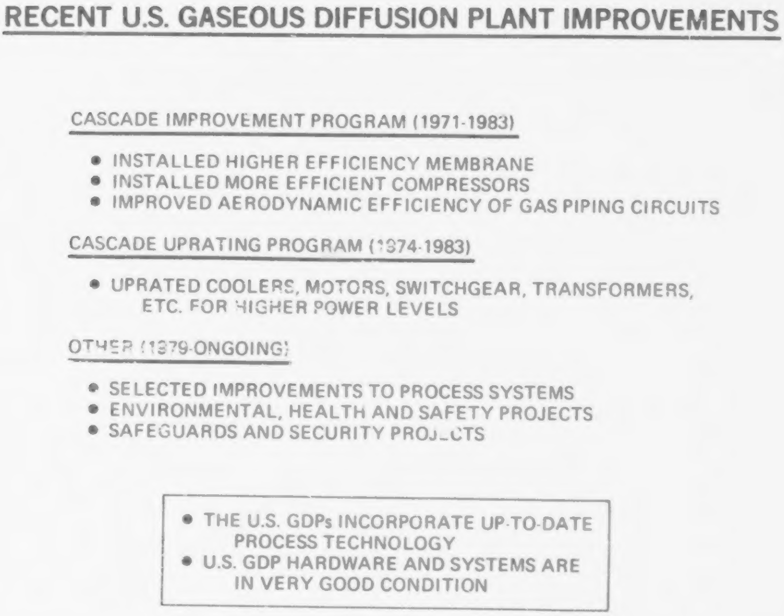


CHART M-9

Again, onstream efficiency is well over 99 percent. This shows how the complex has been operated for the last 10 years, again, fairly unprecedented onstream record. Let me talk about the conditions of the plants. In the 1970's we had programs where we did put in new membrane, more efficient compressors and where we improved the aerodynamic efficiencies of the piping circuits.



RECENT U.S. GASEOUS DIFFUSION PLANT IMPROVEMENTS

CASCADE IMPROVEMENT PROGRAM (1971-1983)

- INSTALLED HIGHER EFFICIENCY MEMBRANE
- INSTALLED MORE EFFICIENT COMPRESSORS
- IMPROVED AERODYNAMIC EFFICIENCY OF GAS PIPING CIRCUITS

CASCADE UPRATING PROGRAM (1974-1983)

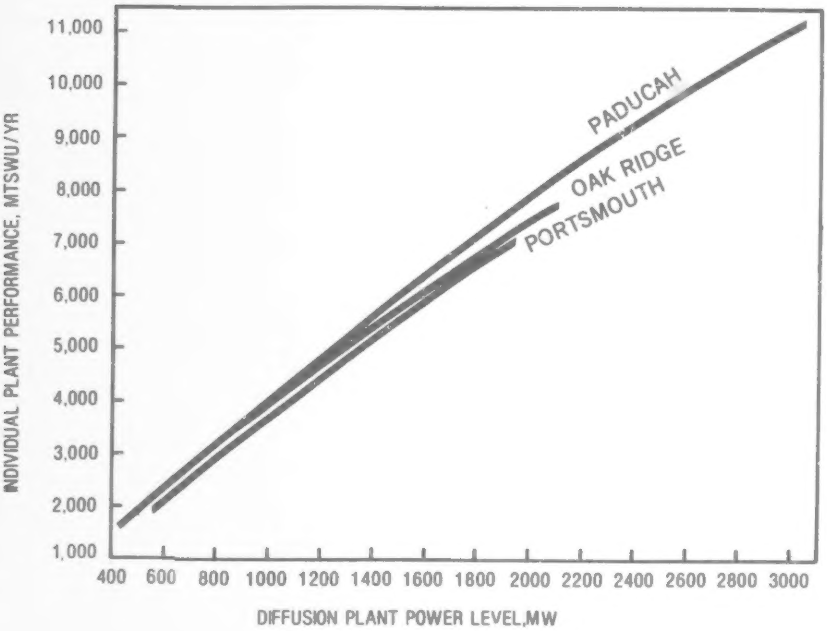
- UPRATED COOLERS, MOTORS, SWITCHGEAR, TRANSFORMERS, ETC. FOR HIGHER POWER LEVELS

OTHER (1979-ONGOING)

- SELECTED IMPROVEMENTS TO PROCESS SYSTEMS
- ENVIRONMENTAL, HEALTH AND SAFETY PROJECTS
- SAFEGUARDS AND SECURITY PROJECTS

- THE U.S. GDPs INCORPORATE UP-TO-DATE PROCESS TECHNOLOGY
- U.S. GDP HARDWARE AND SYSTEMS ARE IN VERY GOOD CONDITION

Also upgraded coolants, motors, switch gear, transformers for the higher power levels and made selective other improvements to operating systems and environmental control systems. The bottom line is that the U.S. diffusion plants do incorporate up-to-date gaseous diffusion process technology second to none, we believe, despite the fact that the European plant is newer—"newer" facility.



INDIVIDUAL PLANT PERFORMANCE VS. POWER LEVEL

CHART M-11

Also the hardware systems in our plants are in very good condition. This shows the diffusion plant performance as a function of power level for the three plants. But it is important to note that the plants are operated not as stand alone plants, but in an integrated fashion. Product at Paducah is used at Portsmouth, and tails from Portsmouth and Oak Ridge are used as feed to the Paducah facility, to achieve greater efficiencies of the total operation.

U. S. GASEOUS DIFFUSION PLANTS

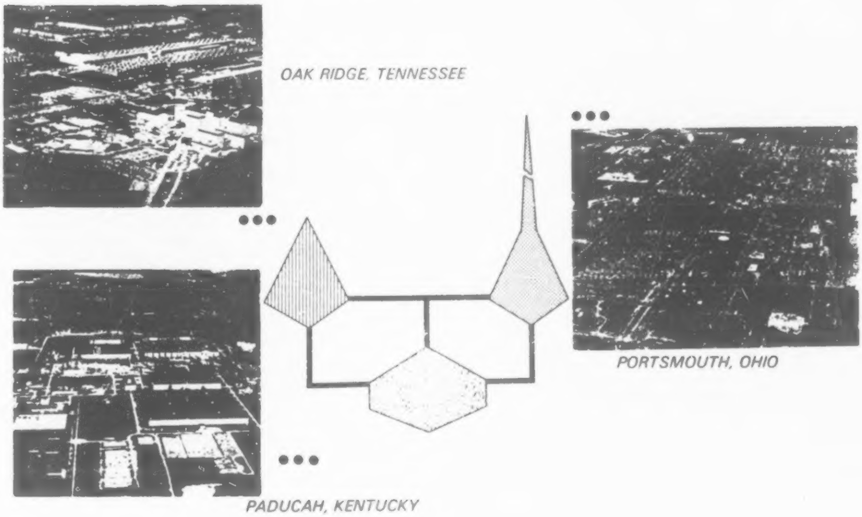


CHART M-12

This represents a 1 percent or so improvement. When you have got a power bill or on the order of a billion or so a year——

Dr. BOHN. Where is the high enrichment being done?

Dr. MERRIMAN. At the Portsmouth plant.

Dr. BOHN. What fraction of the Portsmouth operation is that, or is there any way to make that division?

Dr. MERRIMAN. Yes, it is done. The exact details of that are classified but I will make a comment in a minute about the relative cost, if that would get to your question.

Dr. BOHN. Yes.

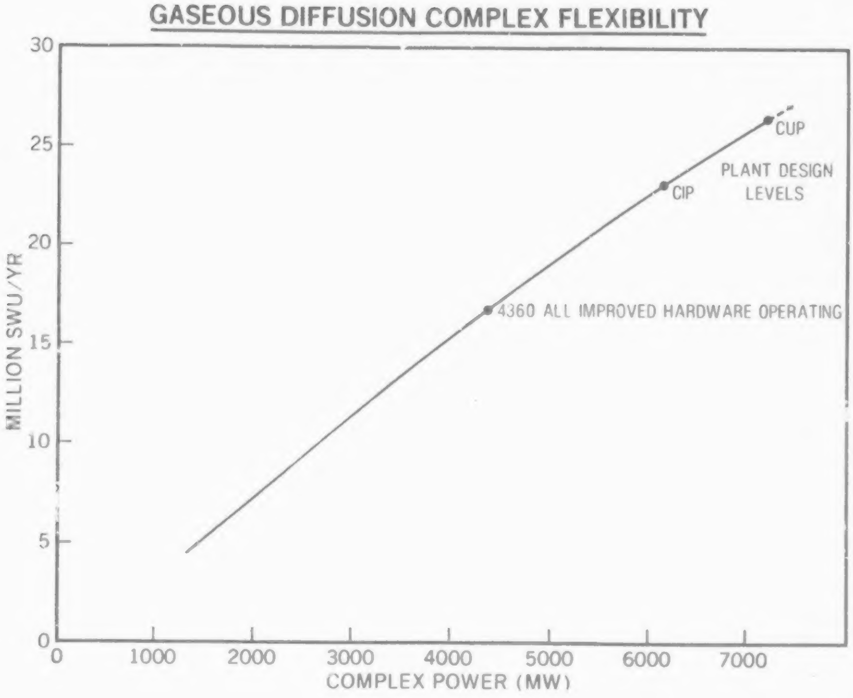


CHART M-13

Dr. MERRIMAN. Because the three plants can be operated as an integrated complex there is great versatility in the operation. What I have tried to detail here is the dynamic range of operation from about 5 million SWU's to 25 million SWU's.

Mr. MEAD. Currently operating where?

Dr. MERRIMAN. Nine million as of July 1. Again, as John Longenecker mentioned yesterday, we are drawing down the preproduction inventory. I will show a couple of curves on cost experience for the first 6 months of 1984 and then talk about the cost projected and incremental costs in 1985.

LEU ENRICHMENT PRODUCTION COSTS
FIRST 6 MONTHS, FY-1984
$/SWU

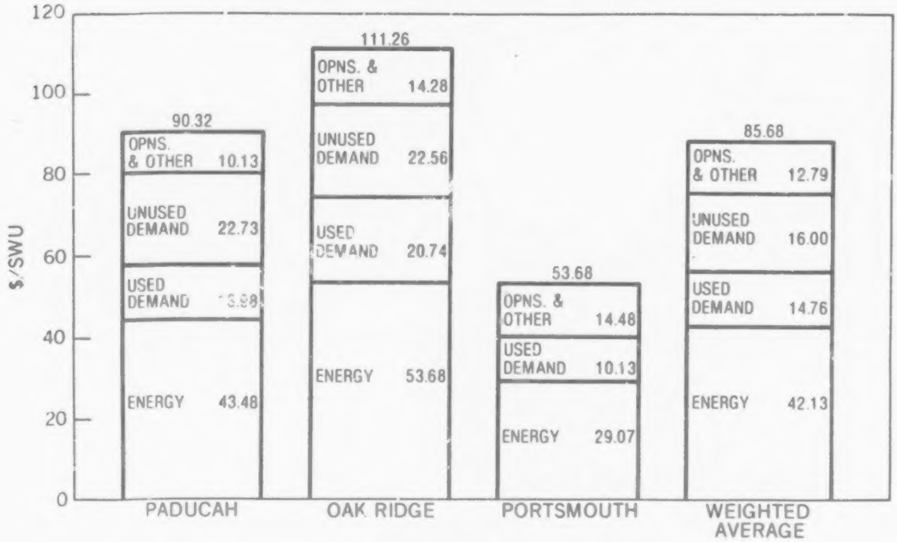


CHART M-14

The aggregated costs, including $16 a SWU, for unused demand for the first 6 months of 1984 was $85.68. Again, this reflects not only energy, and operations of about $13 SWU, but $16 paid to TVA for power not used.

Now, if one makes the assumption that that contractual reliability on the business, per se, and wants to look at more in the nature of out-of-pocket factory costs, then that looks something like this. Again, you see Paducah, Oak Ridge, and Portsmouth costs reflecting essentially the numbers that Bill Clagett showed yesterday of the electric energy charges from our various utility suppliers.

LEU ENRICHMENT PRODUCTION COSTS
FY-84 6 MONTHS $/SWU

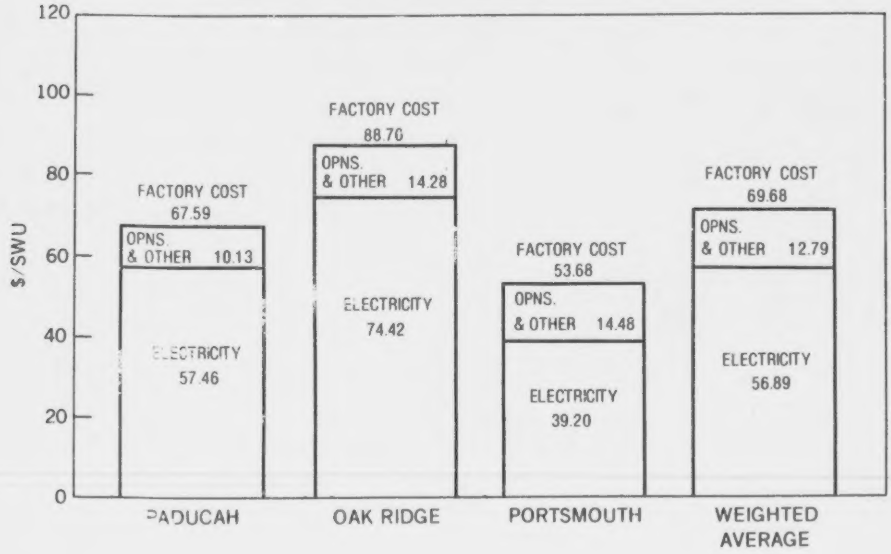


CHART M-15

The aggregated costs out-of-pocket factory cost is around $70 per SWU. Something like that is considered the reasonable target for the advanced technologies, the direct out-of-pocket costs from gaseous diffusion.

Dr. **Whittenbury**. While you have that on, it might be tempting to look at Portsmouth and, say, run that facility only, and then you have got a competitive system in GDP. What is wrong with that?

Dr. **Merriman**. Certainly one of the steps that was taken July 1 was to shift most of the production to Portsmouth. They are now operating at over half capacity and compared to less than 30 percent capacity at the other sites. They are operating at their full contract power level right now because that is where the cheapest electric energy is.

In addition, beginning very shortly, they will be taking some economy power over weekends, and certainly we will optimize the production on the basis of the most attractive cost of production.

The issue with the number of plants in operation and so forth has to do with the point John made yesterday about understanding what our capacity requirements are from gaseous diffusion. The capacity of the Portsmouth plant is about 8.3 million SWU's per year.

So, if gaseous diffusion is needed for more than that, you would have to have two plants, and if it is needed for more than 18 or so million, you need three plants. That is the sort of analysis that is being done right now.

Mr. **Mead**. Paducah is how much?

Dr. **Merriman**. Paducah is 11 something.

Dr. **Bohn**. And you cannot pull a plant?

Dr. **Merriman**. We have looked at that. I would say we have looked at that and, based on the analyses of studies we have done to date, we don't think it is cost effective to put a plant in standby for some short period of years and then bring it back up. What we recommend in the studies that we have underway right now, which are keyed very much to knowing the results of this contract diversion, relate to just the earliest, most cost-effective timeframe and procedure for reducing the total capacity with the notion that once a particular plant was shut down, it would not be restarted.

There are standby costs and costs of layoffs and costs of retraining and so forth that just don't make the standby option appealing, at least at this time.

Dr. **Bohn**. But from a national defense point of view, you might like to have some capacity in reserve?

Dr. **Merriman**. I guess that is certainly true. Again, the issues of the steps taken to undergo a shutdown, that gives you high assurance that you could restart it and whether the reserve is better maintained by just low power operation of more equipment, as opposed to shutting down.

Let me say that at this point, we are in an intensive study phase right now coordinated again with the contract conversion on displacing and phasing out of gaseous diffusion and, in addition to the costs and in addition to the configurations of the complex and in addition to the constraints on shutdown environmental and so forth and socioeconomic factors, we have held public meetings in each of the three towns where diffusion plants are operated.

There is a very significant effort underway to be concluded early in 1985 which will recommend the phaseout for the gaseous diffusion plant. But in the meantime, it is clear from the information Joe Parks provided that under any of these scenarios, and especially if we are successful in attracting customers to the new U.S. contract, gaseous diffusion will be producing a heck of a lot of SWU's for the next decade or so.

What we want to do in gaseous diffusion is get the costs down as quickly as possible to pass that along to the customers of the utilities that buy our product.

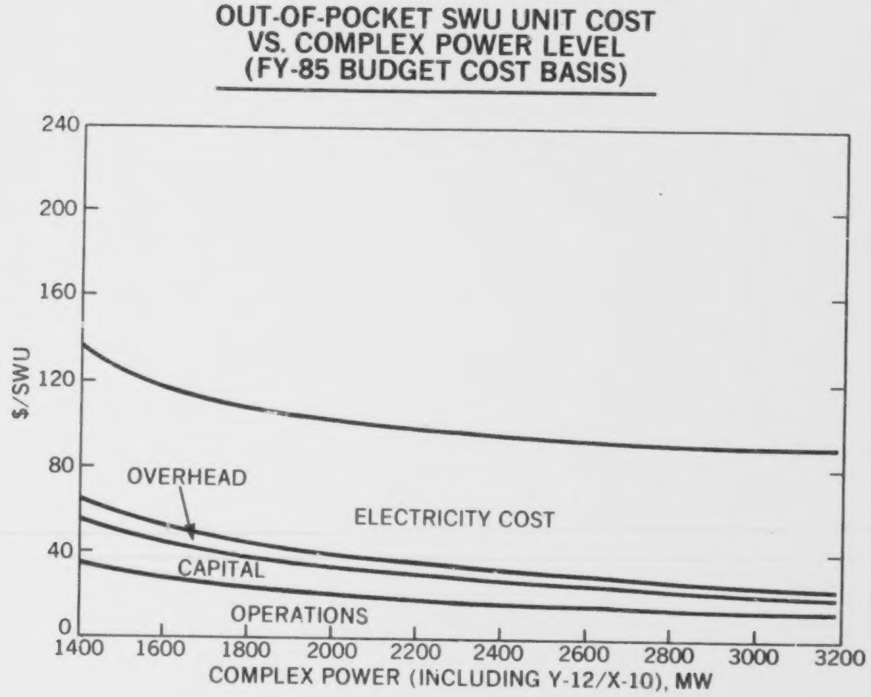


CHART M-16

This shows the projection of the out-of-pocket costs for 1985 over a range of power levels that represents where we are likely to be operating, and, again, you can see something around the $80 range.

Mr. MEAD. Right now you are around 2,500 MW?

Dr. MERRIMAN. Yes, sir.

What this reflects that the previous chart didn't is the additional capital expenditure needed to buy equipment, et cetera.

INCREMENTAL COST OF SEPARATIVE WORK

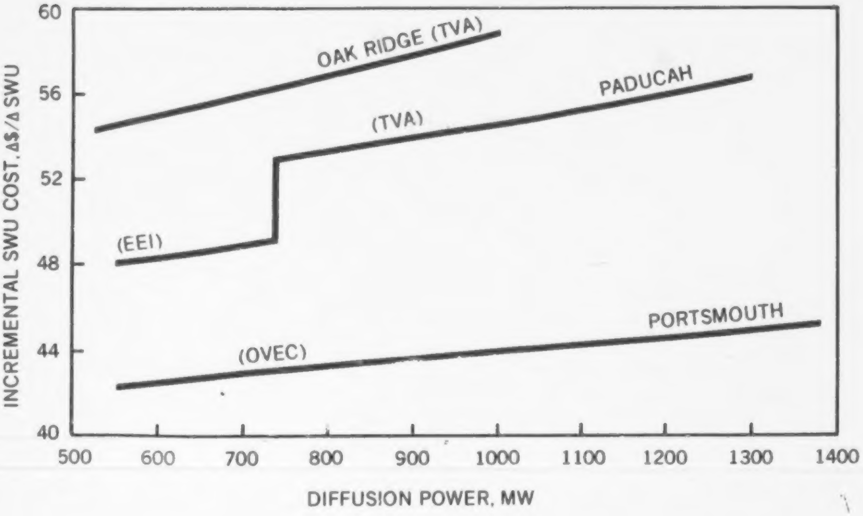


CHART M-17

Then if you look at the incremental costs, you see that is between $40 and $60 a SWU. That is the cost for the next SWU at these power levels and, of course, there is the energy plus, in some cases the use.

Mr. **Potter**. Is any one of these facilities in a lot better shape than the other two, or is one in worse shape?

Dr. **Merriman**. No, again, they were essentially built during the 1970's and early 1980's, all of them.

Mr. **Potter**. They have a useful life in 1984 of how many more years?

Dr. **Merriman**. I would estimate beyond the year 2000. That is another 15 or 20 years.

Mr. **Potter**. Oak Ridge has 8 million, or something like that. Is it 7.7?

Dr. **Merriman**. It is 11.3 at Paducah and 7.7 in Oak Ridge and 8.3 at Portsmouth. And what you can superimpose on this is the contract power level, and, again, get to the position where we are today that we put as much power as we can buy into Portsmouth because it is the cheapest electric energy. That is two-driver, not the relative efficiency or the relevant age of the plants, but the cost of the power, to the degree that power can be cheaper and more mobile, and that smears out differences.

Mr. **Potter**. I understand that, but if Portsmouth was all worn out, for example?

Dr. **Merriman**. But it is not. All of the plants were rebuilt essentially. Now, there will continue to be ongoing capital improvement projects required to keep the plants in compliance with environmental regulations, et cetera, just like in any factory, and that is one of the opportunities for saving money that is associated with phasing down plants, and you get to avoid some of that.

ACTIONS TO REDUCE GASEOUS DIFFUSION COSTS FURTHER

- OPTIMIZATION OF COMPLEX CONFIGURATION
- ON-GOING QUALITY/PRODUCTIVITY IMPROVEMENT PROGRAMS
- COST-EFFECTIVE USE OF TECHNOLOGY
- AGGRESSIVE OPERATIONAL COST MANAGEMENT
- CAREFUL MANAGEMENT OF CAPITAL PROJECTS
- SOME MAJOR NEW INITIATIVES
  - DIVERSIFICATION OF POWER SUPPLIES
  - GREATER TAILORING OF OPERATIONS TO USE ECONOMY POWER
  - ALTERNATIVE COMPLEX CONFIGURATIONS
  - OPTIONS FOR ENRICHING RECYCLED URANIUM
  - FUNCTIONAL CONSOLIDATIONS

CHART M-18

Actions to reduce our costs further are listed here. Nate Hurt will be talking about some of these next.

We want to optimize the complex configuration, again put the production where the costs are cheaper, and that is going on right now. There is more that we can do there.

You will be hearing about the quality of productivity improvement programs. The cost of technology. Nate Hurt will give you some examples of some new hardware that was put in which achieves quite a cost reduction. Aggressive operational cost management. Clyde referred to that a minute ago, and Nate will give you some examples there.

I mentioned this capital project area which is being looked at very carefully, especially as it is associated with the phasing down of capacity. There is a major new initiative. The comments in the back of the room yesterday when Mr. Lee announced his willingness to deliver 18 milipower was from the gaseous diffusion camp because that is exactly what we want to do is to diversify the power supply so that we can have more options for getting that cost down.

We want to take the plants to the limit in terms of their effectiveness of using economy power, seasonal, weekend, off-peak, whatever is available, we want to insure that we have considered its use.

The alternative complex configurations has to do with how much equipment was shut down and when it is shut down and is it whole plants, pieces of plants, standby, lower capacity, or whatever. That is being looked at. Options for enriched and recycled uranium and functional consolidations, which Clyde mentioned a minute ago, eliminating every bit of duplication that might still exist.

U.S. GASEOUS DIFFUSION PROCESS SUMMARY

- LARGE IN-PLACE CAPACITY (27.3 MILLION SWU/YR)
- PROVEN COMMERCIAL OPERATION
    - BASIS OF CURRENT ENRICHMENT BUSINESS
    - 35 YEARS
    - OVER 350 MILLION SWU PRODUCED
    - OVER 99% ON-STREAM EFFICIENCY RECORD
    - OUTSTANDING SAFETY AND ENVIRONMENTAL RECORD
- ROBUST SYSTEMS
    - HIGH COMPONENT AND SYSTEM RELIABILITY
    - EFFICIENT OPERATION OVER A RANGE OF DUTY CYCLES
- MAJOR PROCESS HARDWARE RECENTLY MODERNIZED
- STRONG EMPHASIS ON REDUCING COSTS

CHART M-19

Now, in conclusion, the diffusion process, while it has been in operation for some time, has been greatly improved, and I hope you saw from the costs, is not a terrible process. In fact, we think it is a pretty good process, capable of operating hopefully with some new initiatives and some reductions in the price of electric energy, capable of operating in the $70 per SWU range and perhaps even a little below with incremental costs well below that.

We understand the process well. It is very reliable. It has allowed us to project an image and, in fact, be a reliable supplier in the marketplace. The dependability of that process, the safety and environmental records have been well beyond the comparable records in industry and basically have set the standards in many of those areas.

The process and the hardware are in good condition. The major hardware and plant facilities are in good shape, and there is a strong current emphasis on diffusion costs.

I hope that will give you a point of departure for advanced technology presentations that will follow.

Mr. **Potter**. Let's say that you were given an opportunity to be hired, no salary, nothing, but you can keep 10 percent of all the money you save running these three facilities, your own account, and you have total freedom to do anything you want, would you take the job and, if so, how would you get a decent income?

Mr. **Longenecker**. I see those dollar signs in his eyes.

Dr. **Merriman**. I would certainly take that job right now, and the first thing that I would do is to fly over with a contract to Mr. Lee's office and then I would hit the road for other utility suppliers.

Mr. **Potter**. You are also shouldered with any commitments that the organization may have made before you got there.

Dr. **Merriman**. Then I would debate that a little bit and want an understanding. If it is 10 percent of the money I saved, there are millions and millions and millions of dollars that can be saved by diversifying the power supply, more innovative use of the power, shifting production to economize on the use of power and implementing other cost reduction incentives. So I think there is significant potential for reducing costs with diffusion.

I think you are getting at the point, though, of what is the right cost to label gaseous diffusion with? Is it the $70 an SWU that is our out-of-pocket cost, or is it the $90 an SWU that includes the unused demand charge that is clearly there, because we had gaseous diffusion plants, but is also still there even if you shut down the plants.

Mr. **Potter**. Well, I don't know if you would take the job or not. We had a very good presentation yesterday on the situation with TVA, and if you take a job, you still have that individual's problems. Can you do anything about it? Can you make it better?

Dr. **Merriman**. You talked about the situation with TVA, and I think that has been a frustrating experience for people involved in those negotiations.

I think there are avenues outside of dealing with TVA to bring other electric utilities into the position of supplying electricity to the gaseous diffusion complex, and I think that is a fruitful area for further pursuit.

Mr. **Longenecker**. Excuse me. Is your question really other than power?

Mr. **Potter**. No. Maybe he has some ideas about how to creatively take care of this unused demand. He spends his lifetime there. I spend 10 hours here, and I figure the person that spends his life there knows a lot more about it.

Dr. **Merriman**. Well, there are several alternatives that have been proposed to TVA for reducing, deferring, postponing, eliminating the demand charge. Those are still underway. There is certainly no lack of innovative suggestions to the TVA Board, which is just recently changed. There are really a dozen or so major avenues for fairly setting that, we think.

Mr. **Lee**. Any other questions?

Bob.

Dr. **Bohn**. Are you the person to ask about the cost of high enrichment versus low enrichment?

Dr. **Merriman**. I said I would address that.

Basically, the out-of-pocket costs for the highly enriched uranium are about three to four times the cost of the low-enriched uranium, owing principally to——

Dr. **Bohn**. Per SWU or per kilogram?

Dr. **Merriman**. Per SWU.

Dr. **Bohn**. Three to four times?

Dr. **Merriman**. That is correct.

Mr. **Lee**. So to the extent that all costs are commingled then, the civilian sector is subsidizing defense?

Dr. **Merriman**. That would be a true statement.

Dr. **Bohn**. How much are we talking about? How many SWU's are going to defense?

Dr. **Merriman**. The quantities are very, very low at this point.

Dr. **Bohn**. I thought it was about 10 percent of your total production?

Dr. **Merriman**. No way.

Mr. **Longenecker**. It is 10 percent of our total sales.

Dr. **Bohn**. Then on an incremental basis, it is also 10 percent of your total production?

Mr. **Longenecker**. No. It is 10 percent of our revenues. I think we stated that yesterday. It is roughly 10 percent of our revenue stream, their payments.

Mr. **Potter**. For the highly enriched?

Mr. **Longenecker**. For the highly enriched, yes.

Dr. **Bohn**. And in terms of SWU's projected to be used over the next 5 years——

Mr. **Lee**. Well, then, one of these packets given us yesterday, and we have so many I can't find any of them now, you had that projection.

Mr. **Longenecker**. It is in the interim working scenario.

Mr. **Potter**. I have it in front of me. Are all Government requirements highly enriched, as shown on this chart?

Mr. **Longenecker**. Yes.

Mr. **Potter**. You have 5 out of 25. It seems like it would be 25.

Mr. **Longenecker**. We have two "yeses" and a "no." Let me ask Gene Schmitt to explain that. What we are delivering today is the highly enriched. Let me ask him to clarify two things.

One, the basis for those projections; and, two, how it is that we charge, and to your question specifically, how it is that we segregate the costs between military and civilian. Gene.

Mr. **Schmitt**. Those numbers you have there are the total number of separate work units delivered to the military programs, and it is delivered as high assay material, but the vast majority, about 90 percent of the SWU's are low assay SWU's. So the cost of the low assay SWU is the same, whether it is going to go into further enrichment for the military or be delivered to a commercial customer.

Mr. **Longenecker**. Can I try that too, you have got up to a certain level of enrichment to feed it to Portsmouth. So there is that cost, and then there is the cost, once you get it into that cascade, that takes it to highly enriched to get it up to the level that they need.

Mr. **Lee**. Are you saying it takes 90 percent of the SWU effort to get it up to commercial level enrichment?

Dr. **Merriman**. It is not quite that, but most of the SWU's go into the low assay part.

Mr. **Lee**. So, above commercial level enrichment, you have 10 to 15 percent of the SWU's left to do at three to four times the cost of the first increment?

Dr. **Merriman**. Exactly, and that higher cost for that increment is due to the extra safeguards and precautions that have to be taken for criticality. The differences in relative equipment efficiencies and just the safeguards.

Dr. **Bohn**. So that is actually run as a separate part of the plant?

Dr. MERRIMAN. It is a separate facility, absolutely.

Dr. BOHN. So you could break the costs out of that quite easily?

Dr. MERRIMAN. Yes.

Dr. BOHN. And what are those numbers?

Mr. LONGENECKER. Let me ask Gene to speak to this. We have gone through this in the last year, actually, with GAO in changing how we account in fiscal 1984.

Gene.

Mr. SCHMITT. What we will begin doing in our 1984 financial statements is to segregate those costs and specifically disclose what they are. That hasn't been done in the past. Since we have already announced prices for 1985 and have 1985 budget in, it was too late to make that modification in the budget process in 1985. Beginning in January the fiscal year 1985 budget sector will specifically identify the cost of operating what we call the "Top Building" where the high assay is done.

So from that point on, those costs will be effectively taken out of the commercial program.

Dr. BOHN. You mean that you will charge a different price for those SWU's?

Mr. SCHMITT. We will charge the military two prices, one for low assay SWU's and one for high assay SWU's, previously we did not.

Mr. LONGENECKER. We change our books in 1984, but we don't change literally their payments until 1986 because of the budget process. So in 1986 they will start paying according to the different charge.

Dr. BOHN. John.

Mr. NORRIS. Mr. Chairman, if I might ask a question.

It is my understanding the military doesn't pay cash for depreciation and interest charges which could go into construction at GCEP. To the extent that they don't support the advanced technologies and that they reap the benefits in the 10-year pricing projection, isn't it true that civilian users are subsidizing the military in allowing them to reap the benefits of the pricing or costs over the 10-year period, even though they are not supporting that development?

Mr. SCHMITT. Again, I would have to answer that in two parts, on the budget part and the accounting part.

In the accounting or pricing part, no, they are not being subsidized because again they are in the denominator, so they are covering their share of depreciation so that the calculated price that goes to the commercial customer does not include any depreciation for GCEP. There is a total allocation between commercial and Government.

There is no problem there, but I think the point you raise on the budget side, however, because the budget does not include interest and depreciation, there is no direct funds being provided in the budget process from the government programs to help the budget equation. That is true.

Mr. NORRIS. But they are reaping the benefits of the lower costs from the budget costs?

Mr. SCHMITT. Well, when the technologies are brought on line, presumably the low assay SWU's portion will come out, and equal share will come out of those facilities, yes.

Mr. **Lee**. Under zero appropriation type charge you operate under, I think the point is isn't it that the cash provided for the new development comes from one source only, and that is not military and that to the extent that those new technologies are going to reduce the SWU cost, then all customers would enjoy it, is that not correct?

Mr. **Schmitt**. Yes.

Mr. **Lee**. Thank you.

Bob, thank you. Thank you, Gene.

Let's move right along.

Mr. **Hopkins**. Could I make a point? We had quite a discussion about standby versus phaseout of the diffusion plant, and I want to make sure you understood that as far as Martin Marietta is concerned, we are ready and willing to phase out one of our plants when the market demand says we ought to do that.

The only thing we are grappling with is whether it is more appropriate to put one in standby and start it up again, but we have no problem with shutting down one of our plants.

Mr. **Lee**. So you simply can't answer the cost effectiveness question of mothballing it as opposed to shutting it down and forgetting it?

Mr. **Hopkins**. Not yet.

Mr. **Potter**. How long have you been studying that?

Mr. **Hopkins**. Just really getting underway. We haven't really studied it carefully. By the time we know what our market demands are in October, we will have an answer.

Dr. **Merriman**. That is again the study that I referred to to be completed in January 1985?

Mr. **Lee**. Thank you for clarifying that.

Next we are going to hear about gas centrifuge.

Mr. **Longenecker**. One question we didn't answer you on. Is all the material in the next 10 years LEU? I had answered that the material we are delivering today is all LEU. In the next 10 years, there are projections, and I can't specify because of their classification for systems, that would require some LEU and some other enrichments, and that is shown in those total SWU's.

So those SWU totals that you see there are both the estimates of work to get it up to feed high cascade and then an additional amount to get it out.

Mr. **Lee**. I understand.

Mr. **Longenecker**. Next we are going to finish off the gaseous diffusion plant discussion. You have heard how highly motivated and aggressive they are and their motivation in life is to stay in business, so they are trying to set the highest, toughest target that they can for the advanced technologies to shoot at.

What you asked them to do is exactly what they are doing right now, but for a different motivation. I can't give them a percentage of what they save, but we can make the gaseous diffusion a much more competitive technology for a longer period of time. What we would like to do, Bill, is before wrapping up gaseous diffusion is tell you some of the things we are doing to save money near-term to get the price down and then talk about how some of those might pay off in the future.

Mr. **Lee**. All right, let's look at that.

Mr. LONGENECKER. This is Nate Hurt, who is the Manager of the Portsmouth operation.

Mr. HURT. Good morning, Mr. Chairman, and panel.

Mr. LEE. Good morning, Mr. Hurt.

Mr. HURT. We are one of the three members of the uranium enrichment team that is primarily devoted to the diffusion process. Martin Marietta, Goodyear Atomic, and the Department of Energy.

I just want to cover briefly with you, since Dr. Merriman and Mr. Hopkins have gone through the process and have described some of the changes to the plant and methods of efficiency and such, those things which we have done, particularly in the last few years, to try to keep the costs down, recognizing what the situation was in in the enrichment industry.

Recognizing that power was the major cost and people have already talked on that, we then go back, and we will want to look at what are the other costs and what have we done about those. So what we have here is a chart that shows the diffusion costs. The fiscal year 1981 escalated costs versus the actual.

Now, what we are showing here on the top, we use 1981 as a base because, recognizing what the situation was within the management of the teams, we started really concentrating in the reduction of costs, keeping costs down, and then in the last year, year and a half, we have really stepped up that program.

But what we have here, the upper curve, the dashed line is the curve that we would have on allowing for the actual labor costs, that is, the wages and the salaries that we were paying and the CPI being used for the cost of the materials.

The lower curve here is what our actual costs have been, and then we have phantomed that out as to what our projections are for the fiscal year 1985.

Mr. MEAD. Let me understand what you are saying. That lower curve is 1981 dollars?

Mr. HURT. No, it is actual.

Mr. MEAD. These are then year dollars?

Mr. HURT. Yes. And that is for all three plants.

Now, each of the plants, if you looked at their individual curve, you would see have contributed equally to this. They would be about the same.

Now, what we are showing here though is that had we stayed on this curve and operated as we had been, we would be about $23 million higher than we are using in fiscal year 1984 as our operating costs. These costs exclude power for the cascade and exclude depreciation. So they really consist of the wages and the salaries, the overheads and the material costs.

Now, we are showing that our projections will extend out here so that we were going to be close to $39 million ahead of what we would have been had we stayed on the straight escalation basis.

Mr. MEAD. Those are mostly people costs?

Mr. HURT. Mostly people, yes.

To give you some idea that this was not due to a significant change in the production of SWU's, this overlay shows the SWU production during those years.

You will notice that there is an increase from 1981 to 1982 to 1983. That increase is essentially due to the efficiency gain in the plant because we were operating at the same power level at all three plants during those years. The total for the three plants was the same, and this was due to the improvement and upgrading program that had been started in the 1970's and completed in the early 1980's.

An increase in the power for fiscal year 1984, particularly starting in April of this year, and then a projection as to what the SWU dropoff will be as we cut back on the power somewhat in the next year.

You were right, Mr. Mead, that that is essentially manpower because manpower is about 65 percent of all other operating costs or what we know as factory cost less power.

In 1981, at the three plants in terms of bodies, we had 5,408 people on the payroll that were dedicated to diffusion operations. Fiscal year 1984, we were at 4,266. We are down about 25 percent. We are projecting that we are going to go on down to about the 4,000 level for the next year of operation.

The things that have made that possible are changes in the management style at the plants. The initiatives that management has taken, the management and the supervision working together. Extensive organizational restructuring. We have cut out layers of management. We have combined jobs so that we could reduce hourly payroll.

As an example, at the Portsmouth plant, within the last year, we have reduced 32 salary units by the reduction in the layers of management. We have taken that steep peak and flattened that out. This, of course, helps us improve our communications too, but we took out one manager, which is our second layer or second tier, two superintendents, eight supervisors and the balance of the 32 were former, general former and technical people that were directly associated.

We also had gone into extensive employee involvement programs. Some of you know this as participative management. Some of you know this as a quality circle. Some call it organizational effectiveness, but to us, it has meant bringing the employee all the way down to the janitor in on as much knowledge as we could share with him to make him feel a part of the team and recognize that he contributed significantly to the cost reductions that we needed in the plant.

We conduct economic awareness programs. We share everything that we possibly can through sessions with people. As an example, at the Portsmouth plant, we have gone through 1,600 people up to date with our program, and we will go through another 1,400 within the next 3 weeks.

We have extended and improved the quality assurance programs at all three plants and as far as we are concerned, quality assurance program improvements bring about increased productivity.

We have improved the training programs. We have gone to performance based training programs, reduced the cost of training for people, and remember this type of operation being associated with the nuclear industry is just like in the reactor programs, we continually retrain these people as we shift them from one job to the other. Every year we refreshed their training so that we are sure they are not going to make any operational errors.

We are now expanding the use of process statistical control, and we have always used that to some extent at all three plants, in our sampling process and in some of our incoming materials.

Mr. **Lee**. Excuse me, Mr. Hurt. We are falling a good bit behind our schedule. We have got a lot of ground to cover today. I just wish you would say a word about each bullet on your chart so we can move right on. I apologize for having to do that. I know you want to show the good work you have been doing. But it is necessary that we try to regain some time because this panel is going to finish its public work this morning so that we can go into executive session this afternoon. So please hurry along.

Mr. **Hurt**. We will respond to that.

Mr. **Lee**. Could we have the next chart please?

Mr. **Hurt**. We have gone through extensive resource consolidation which means the facilities and the people. We consolidate the facilities, for instance, at the Portsmouth plant where we have two centrifuge plants being built since Goodyear will be the operator for that, through the design and the construction, we have consolidated so that we use central facilities.

Organizationally, we have set up so we have a central organization that provides services to both plants, and we eliminate duplication.

There has already been a lot of discussion on the coordination that goes on between the three plants. This is being extended now so that we will be going into what we call centers of excellence and business centers. Centers of excellence is where we will designate some person at one site to be the specialist on that and the others will participate. As far as the business centers, that is to extend the use of cost centers at each plant among the three plants.

Energy management is very big with us. You have already heard from others previously about what we are doing with power. This coming weekend, we will be, for the first time, at the Portsmouth plant going into the off-peak power usage from OVEC. We are working out the details of that with them right now.

Waste heat recovery, in the past we have sent a lot of heat up to the atmosphere from these enormous cooling towers, and we are cutting that back now by using it for heating facilities, and we will extend that even further.

Our technological actions at the plants are based on a program that we know as the process and long-range technical support program, which we are maintaining now at a very modest level, but just enough to insure that the safe, efficient operations are continued and we will continue to extend that.

That has been cut back significantly, though, because 3 plants 3 years ago had 115 people involved in this, and we are dropping down now to a level of about 80.

Capital projects, we have gone through and reviewed all of the capital projects that we had on the books to see which ones that we could cancel out or we could screen down considerably.

So the end result is going back to this, we have effected this much of a drop, and we are going to effect that much, and that is all through the prudent and effective use of the energy and facilities, people and technology, the result is cost savings. We have a firm commitment to the Department of Energy and to this country to get these costs even lower and to thus provide DOE with the best economic target for evaluation of the new technologies.

Mr. **Lee**. Very good. Thank you, Mr. Hurt.

Mr. **Longenecker**. Mr. Chairman, the reason for showing that obviously is there is tens of millions of dollars there, and we are out after it, and we wanted to show you some examples.

We would like to move onto the centrifuge. We will try to pick up some time in going through those. We will split it into two pieces. First we want to tell you about GCEP and what it is and what we have built, and then tell you about AGC's and how the Set V's can fit into that.

GAS CENTRIFUGE ENRICHMENT PROGRAM

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

August 17, 1984

GAS CENTRIFUGE TECHNOLOGY
GAS CENTRIFUGE ENRICHMENT PLANT PROJECT (GCEP)
GAS CENTRIFUGE ENRICHMENT PLANT START-UP

EWIN B. KISER, JR.
Assistant Manager
For
Enriching Operations And Development
Oak Ridge Operations

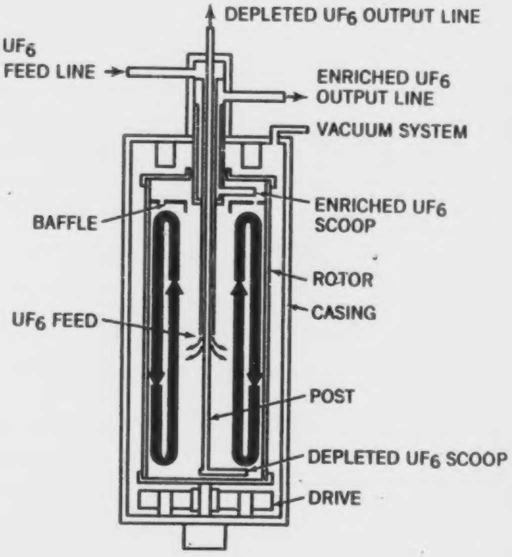
GAS CENTRIFUGE ENRICHMENT PROGRAM

GAS CENTRIFUGE TECHNOLOGY

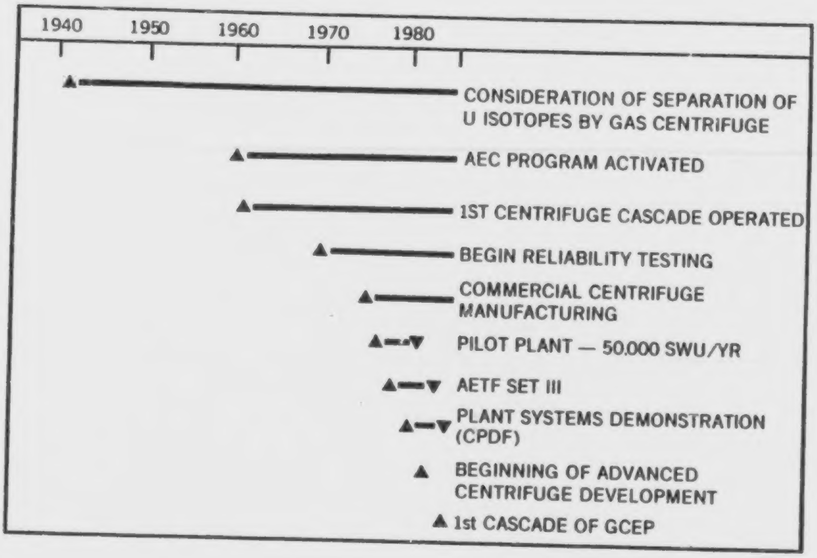
THE GAS CENTRIFUGE

MAIN ELEMENTS:

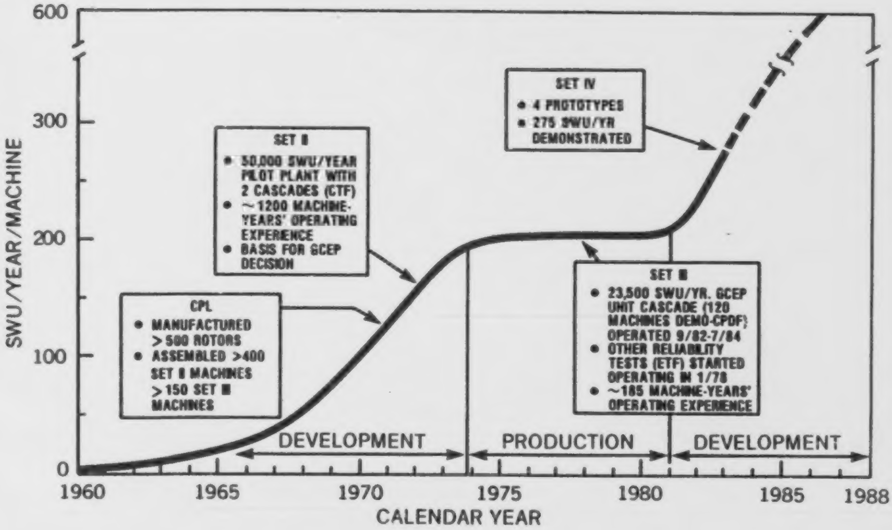
- ROTOR SYSTEM
  - ROTOR ASSEMBLY
  - TOP AND BOTTOM SUSPENSIONS
- DRIVE SYSTEM
- CASING
- GAS HANDLING SYSTEM



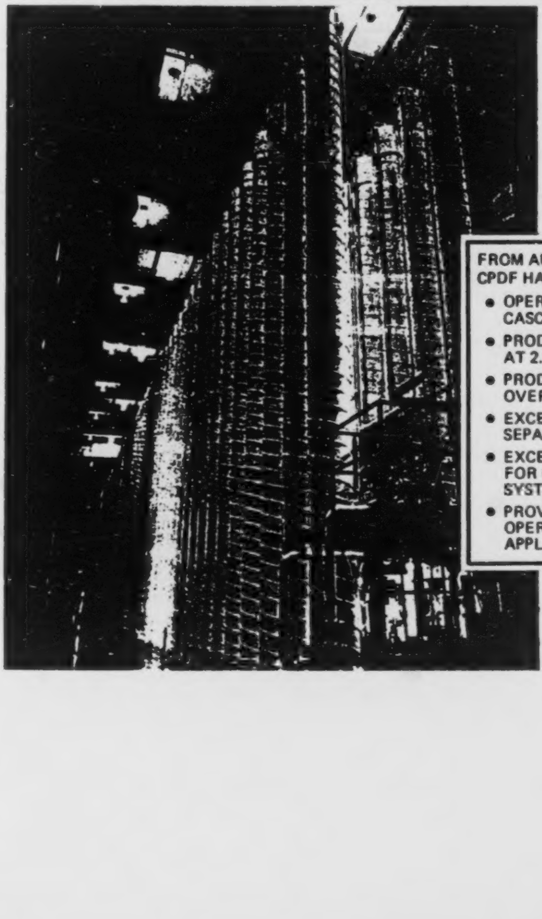
THE U.S. DEVELOPMENT OF THE GAS CENTRIFUGE



DEVELOPMENT PROGRESS



CASCADE OF P1 MACHINES IN THE CENTRIFUGE PLANT DEMONSTRATION FACILITY



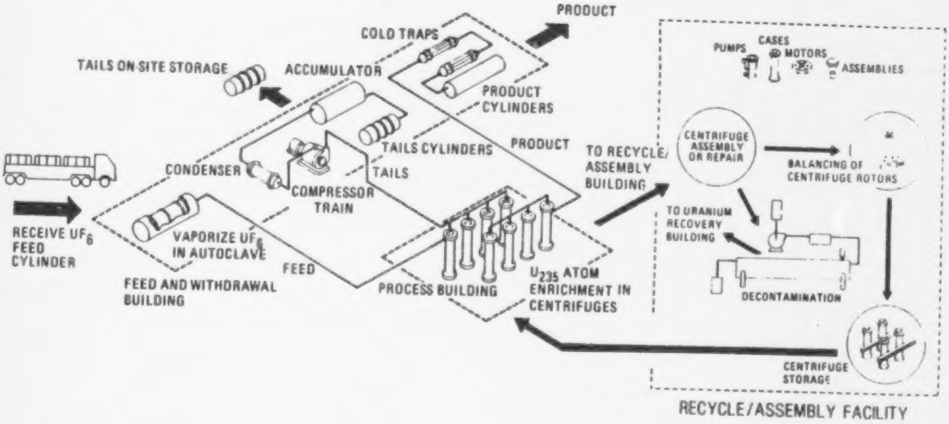
FROM AUGUST 1982 THROUGH JULY 1984, CPDF HAS:

- OPERATED OVER 16,283 HRS ON CASCADE THROUGHPUT
- PRODUCED 39,079 LB. UF_6 PRODUCT AT 2.84% ASSAY
- PRODUCED 42,190 SWU VALUED AT OVER $5.85 M
- EXCEEDED TARGET GCEP CASCADE SEPARATIVE WORK OUTPUT
- EXCEEDED TARGET AVAILABILITY FOR GCEP CENTRIFUGES AND BOP SYSTEMS
- PROVIDED IMPORTANT TEST AND OPERATING DATA FOR GCEP APPLICATION

CENTRIFUGE DEVELOPMENT FACILITIES, OAK RIDGE

GAS CENTRIFUGE ENRICHMENT PLANT

CENTRIFUGE URANIUM ENRICHMENT PROCESS


PRODUCT
COLD TRAPS
TAILS ON-SITE STORAGE
ACCUMULATOR
PRODUCT CYLINDERS
PUMPS
CASES
MOTORS
ASSEMBLIES
TAILS CYLINDERS
PRODUCT
TO RECYCLE/ ASSEMBLY BUILDING
CENTRIFUGE ASSEMBLY OR REPAIR
BALANCING OF CENTRIFUGE ROTORS
CONDENSER
TAILS
COMPRESSOR TRAIN
RECEIVE UF6 FEED CYLINDER
VAPORIZE UF6 IN AUTOCLAVE
FEED
FEED AND WITHDRAWAL BUILDING
PROCESS BUILDING
U235 ATOM ENRICHMENT IN CENTRIFUGES
TO URANIUM RECOVERY BUILDING
DECONTAMINATION
CENTRIFUGE STORAGE
RECYCLE/ASSEMBLY FACILITY

GAS CENTRIFUGE ENRICHMENT PROGRAM

GAS CENTRIFUGE ENRICHMENT PLANT PROJECT (GCEP)

GAS CENTRIFUGE ENRICHMENT PLANT

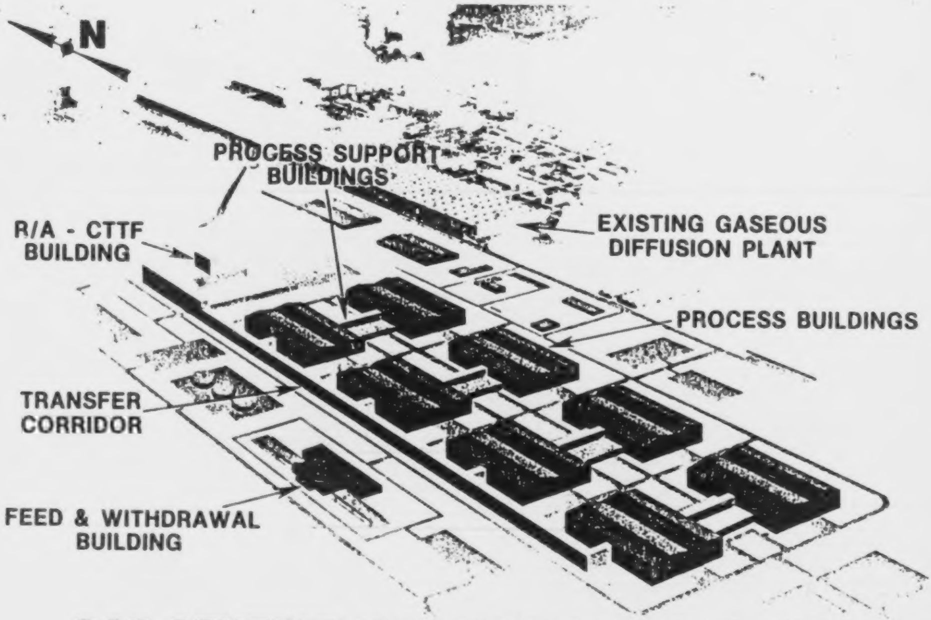
PROJECT OBJECTIVE AND TECHNICAL BASELINE

PROJECT OBJECTIVE: Provide Replacement Centrifuge Capacity With Production Costs Substantially Lower Than Diffusion Costs.

TECHNICAL BASELINE:

- FEED: Normal 0.711% U-235
- PRODUCT: Range 2.5% - 3.2% U-235
- TAILS: Assay Range 0.20% - 0.25% U-235
- CAPACITY: 13,200,000 SWU/YR
- FIRST TRAIN OPERATIONAL BY SEPTEMBER 1985 (720 CENTRIFUGE MACHINES)
- FIRST 550,000 SWU/YR (1/2 PROCESS BUILDING) BY JANUARY 1987
- REMAINING CAPACITY BY 1994

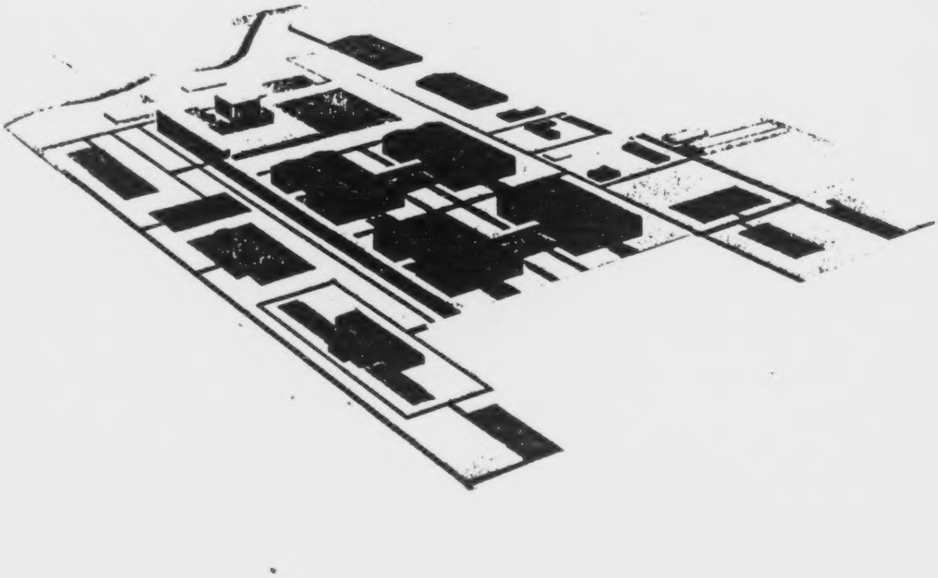
GAS CENTRIFUGE ENRICHMENT PLANT


N
PROCESS SUPPORT BUILDINGS
R/A - CTTF BUILDING
EXISTING GASEOUS DIFFUSION PLANT
PROCESS BUILDINGS
TRANSFER CORRIDOR
FEED & WITHDRAWAL BUILDING

GAS CENTRIFUGE ENRICHMENT PLANT
PORTSMOUTH, OHIO

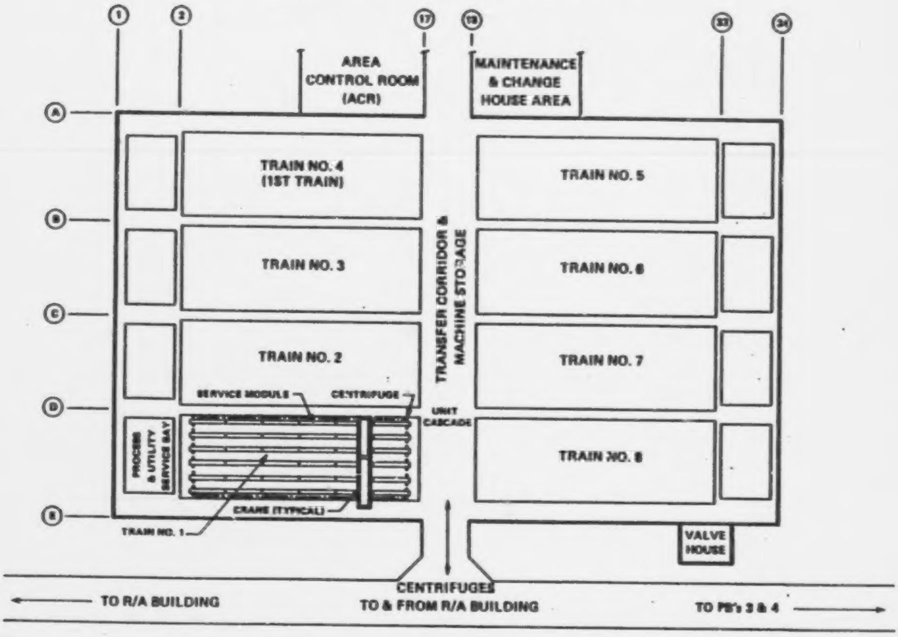
GAS CENTRIFUGE ENRICHMENT PLANT

PORTSMOUTH, OHIO



GAS CENTRIFUGE ENRICHMENT PLANT

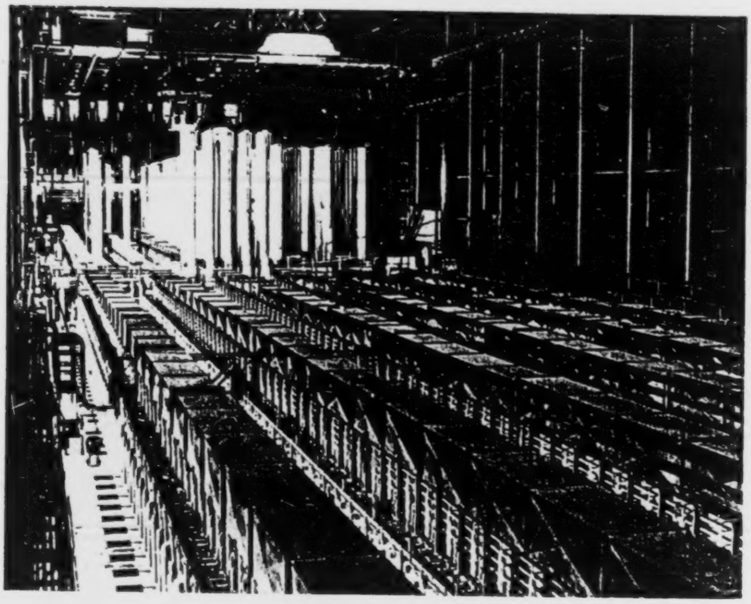
PROCESS BUILDING NO. 1 LAYOUT



GAS CENTRIFUGE ENRICHMENT PLANT

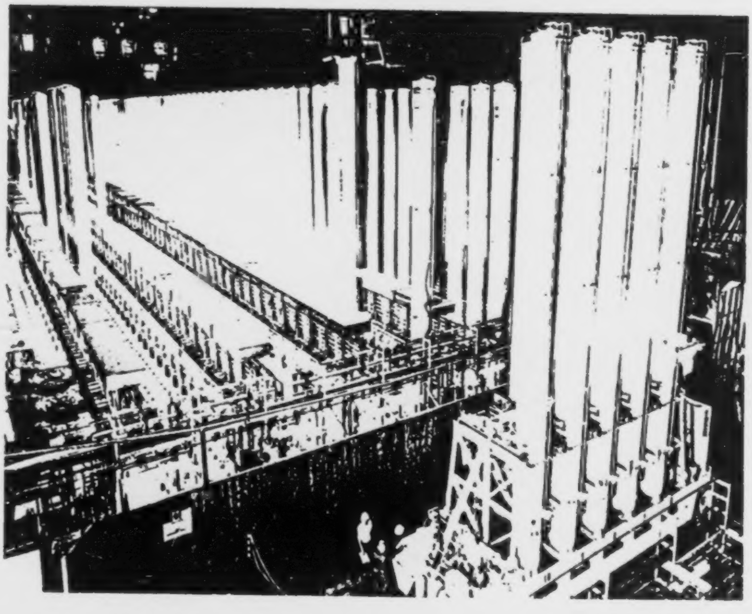
AERIAL VIEW OF THE GAS CENTRIFUGE ENRICHMENT PLANT AT PIKETON, OHIO

GAS CENTRIFUGE ENRICHMENT PLANT



INSTALLED CENTRIFUGE MACHINES IN PROCESS BUILDING NO. 1, TRAIN 4
April 1984

GAS CENTRIFUGE ENRICHMENT PLANT



PROCESS BUILDING NO.1, TRAIN 4 WITH INTRAPLANT TRANSPORTER
May 1984

GAS CENTRIFUGE ENRICHMENT PLANT

COST/SCHEDULE STATUS

PROJECT ESTIMATE

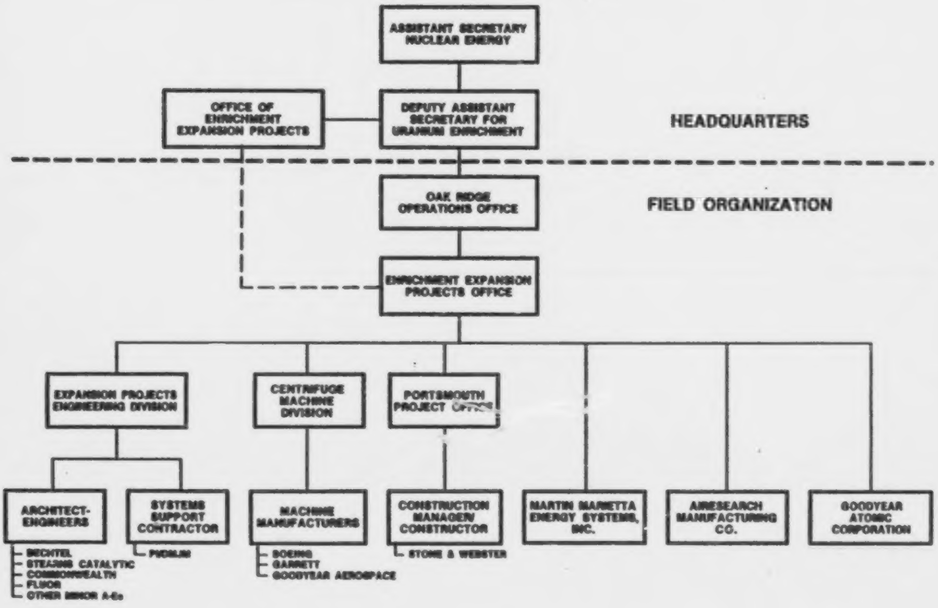
- 8 Building Baseline GCEP - $6.8 B (1983 $'s)
- Stable Since 1978 Excluding:
  - Inflation
  - Programatic Schedule Changes
- All Elements Of Estimate Have Been Tested In The Marketplace Including Machines
- All Construction And Procurement On A Fixed Price Basis (Except Machines)
- Set V Machine Costs Subject To New Design; However, Set III Cost Experience Is Relevant

FORWARD COST PROJECTIONS CAN BE MADE
WITH HIGH DEGREE OF CONFIDENCE

TEC-STABLE

GAS CENTRIFUGE ENRICHMENT PLANT

PROGRAM/PROJECT MANAGEMENT STRUCTURE


ASSISTANT SECRETARY NUCLEAR ENERGY
OFFICE OF ENRICHMENT EXPANSION PROJECTS
DEPUTY ASSISTANT SECRETARY FOR URANIUM ENRICHMENT
HEADQUARTERS
OAK RIDGE OPERATIONS OFFICE
FIELD ORGANIZATION
ENRICHMENT EXPANSION PROJECTS OFFICE
EXPANSION PROJECTS ENGINEERING DIVISION
CENTRIFUGE MACHINE DIVISION
PORTSMOUTH PROJECT OFFICE
ARCHITECT-ENGINEERS
BECHTEL
STEARNS CATALYTIC
COMMONWEALTH
FLUOR
OTHER MINOR A-Es
SYSTEMS SUPPORT CONTRACTOR
MACHINE MANUFACTURERS
BOEING
GARRETT
GOODYEAR AEROSPACE
CONSTRUCTION MANAGER/ CONSTRUCTOR
STONE & WEBSTER
MARTIN MARIETTA ENERGY SYSTEMS, INC.
AIRESEARCH MANUFACTURING CO.
GOODYEAR ATOMIC CORPORATION

GAS CENTRIFUGE ENRICHMENT PLANT

PRINCIPAL DOE PRIME CONTRACTORS

FIRM	TASK
MARTIN MARIETTA ENERGY SYSTEMS, INC.	PROCESS DESIGN & PROCUREMENT
AIRESEARCH MFG. CO.	CENTRIFUGE MACHINE & R/A EQUIPMENT DESIGN
GOODYEAR ATOMIC CORP.	PLANT OPERATOR
STEARNS CATALYTIC, INC.	SITE WORK AND SUPPORT FACILITY DESIGN
BECHTEL NATIONAL, INC.	R/A FACILITY DESIGN
FLUOR ENGINEERS & CONSTRUCTORS, INC.	PROCESS FACILITY DESIGN
COMMONWEALTH ASSOCIATES, INC.	ELECTRICAL DISTRIBUTION DESIGN
PRESEARCH INCORPORATED DANIEL, MANN, JOHNSON, & MENDENHALL	SYSTEMS ENGINEERING & MANAGEMENT SUPPORT
STONE & WEBSTER ENG. CORP.	CONSTRUCTION MANAGEMENT
BOEING ENGINEERING CO. SOUTHEAST, INC.	MACHINE MANUFACTURE
GARRETT CORP.	MACHINE MANUFACTURE
GOODYEAR AEROSPACE CORP.	MACHINE MANUFACTURE

GAS CENTRIFUGE ENRICHMENT PLANT

PROJECT CONTROL ACTIVITIES ESTABLISHED

- PROJECT MANAGEMENT PLAN
- PROJECT MILESTONES & SCHEDULE
- CONFIGURATION MANAGEMENT
- FINANCIAL MANAGEMENT PLAN
- PROJECT DOCUMENT TREE
- PROCUREMENT RESPONSIBILITY PLAN
- COST/SCHEDULE CONTROL AND REPORTING SYSTEM
- INTERFACE CONTROL PLAN
- QUALITY ASSURANCE REQUIREMENTS
- SYSTEMS ENGINEERING MANAGEMENT PLAN
- PROJECT COST ESTIMATE

GAS CENTRIFUGE ENRICHMENT PLANT

CONTINUING/FUTURE ACTIVITIES

- DOWNSCOPING ALL SET III EFFORTS NOT APPLICABLE TO OPERATION OF SET III MACHINES OR SET V NEEDS
- MANUFACTURE SET III MACHINES FOR ONLY ½ PROCESS BUILDING
- FIRST TRAIN (720 Machines) ON THRU-PUT BY SEPTEMBER 1985
- DESIGNING FOR CONVERSION OF GCEP WITH SET V MACHINES

- MINIMIZE SET III COSTS
- MINOR MODIFICATIONS REQUIRED FOR SET V IMPLEMENTATION

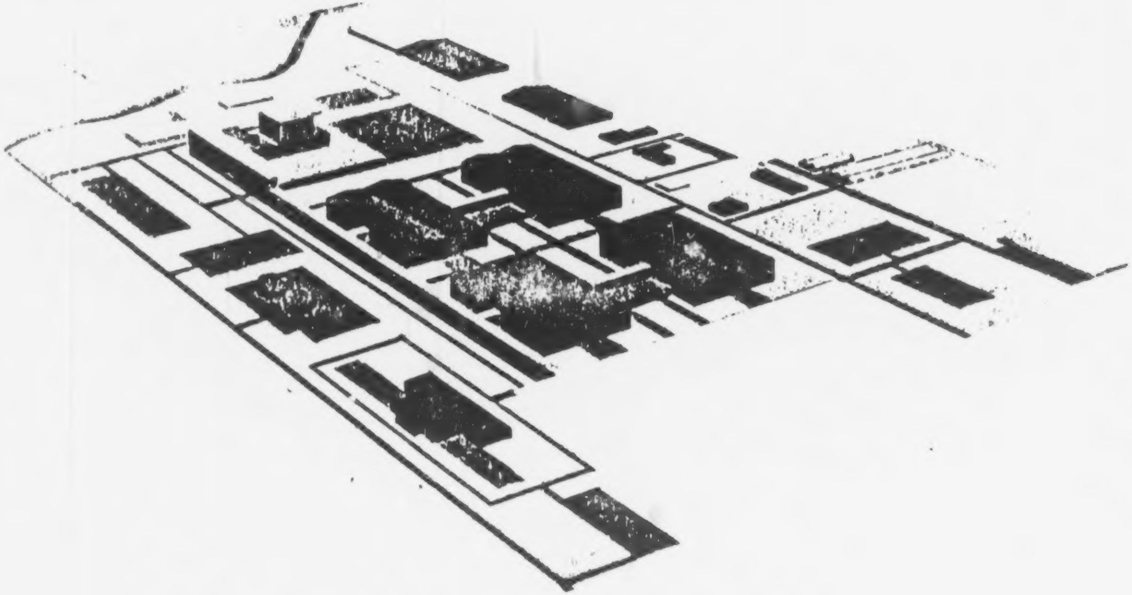
GAS CENTRIFUGE ENRICHMENT PLANT

SUMMARY

- CENTRIFUGE TECHNOLOGY PROVEN
- MANAGEMENT TOOLS IN PLACE
- PROJECT IS WELL ALONG IN THE CONSTRUCTION AND EQUIPMENT STAGES
- MACHINES QUALIFIED AND IN PRODUCTION
- EXCELLENT PERFORMANCE
  - Project On Schedule
  - Project On Cost/Budget
- START-UP ACTIVITIES PROGRESSING
- ADAPTABLE TO TECHNOLOGY ADVANCES

GAS CENTRIFUGE ENRICHMENT PLANT

PORTSMOUTH, OHIO



Mr. KISER. Mr. Chairman, I want to show the components of the centrifuge to apply to some of the terms you will be seeing later to do a little better job. This is a 1958 model we started with this II program. It is in a vacuum casing with a rotor that spins very fast. The UF_6 fed into the rotor. The artificial gravitational field forces the 238 closer to the cylinder, and then the 235 and that provides the separation. You take the two products off at the top and bottom. It is a simple process.

We are using the same concept we started with. The key features that we have improved are length, capacity, increase proportional length, exponentially to the speed and with the efficiency of the containing the flow of gas inside the machine.

An overview of the program. Actually, the centrifuge was considered in World War II or use of uranium enrichment losing out essentialy due to the materials not being strong enough to support that machine. The AGC program started in 1960 starting with the little model I have shown. The first cascade of machines significantly bigger than that were cascaded in 1963.

First reliability testing began during the latter part of the sixties with the Set I machines introduced the commercial interest in the early 1970's, principally through the industrial participation program initiated with the thought that industry could pick up and build the next capacity. Out of that came the technology that these centrifuge manufacturing people are using today.

The Set II pilot plant operated for several years. The Set II machine, significant number of machines, or about 400, producing about 50,000 SWU's per year. The first reliability testing in the AETF Advanced Equipment Test Facility of the Set III machines took place in this period. The CPDF was, Centrifuge Plant Demonstration Facility, was used for systems testing and machine testing of the Set III. I will be touching on that more as we move along.

The growth and capacity of the machines can be illustrated by this chart, starting with the model in the early sixties.

Cascading the machines in 1963, as you can see, the green line is showing the expansion of capacity through time as developments proceeded entered into manufacturing demonstrations in the early 1970s, produced machines for the pilot-plant, ran the pilot-plant for a number of years, went through the testing of Set III in this period and recognizing that there was still some technology left, began to do some advance work on what we called Set IV.

And you can see that we actually moved up continuing on the curve. Recognizing that there were limitations on the materials being used in the Set III machines and seeing the opportunity for new and better materials that would permit potential capacity increases up to a factor of three of the Set III machines, as was said yesterday, and we abandoned that and went for the big stretch.

The Centrifuge Plant Demonstration Facility, this is a full cascade of machines that contains the entire system for enriching by centrifuge, has been run for a couple of years, and we shut it down just a few months ago. It has served its objectives. The objectives were for a full system testing of enriching process as well as testing the machines.

We intended from the outset, that when we reached Set I, to shut it down. We did, and there are others that pick up the reliability testing.

These are the large facilities that have housed most of the large equipment for testing.

There is more to the process than just the machine. This is a typical process, one that is used in the CPDF identical to one we use in Portsmouth. The process using in UF_6 is the same type we use in the diffusion plants. It goes into the cascade of machines. The separation takes place with the product continuing, as shown in the diagram, condensed, and goes into the cylinders and produces gaseous UF_6, and we take it off.

The centrifuges themselves are assembled and maintained in what we call a recycle assembly facility. We receive at the GCEP machines packaged in parts, pieces. They are assembled, go into the enrichment plant. If there is a maintenance problem, these machines are taken out and can be replaced.

In summary, the machines have increased in capacity by orders of magnitude since we began. The operating testing experience has been substantial. The Set III machine has been qualified to be produced for GCEP. The advancements in the technology will be described by Mr. Sommerfeld.

The objective is to replace the GDP process striving for the lowest cost and the technical base line, as you can see.

Mr. LEE. Hold it right there a minute. What track are we on for that one-half of the first building; the first 550,000 SWU per year will be Set III machines?

Mr. KISER. That is correct.

Mr. LEE. And that is committed and on track, machines have been ordered?

Mr. KISER. Yes, those machines are being produced by centrifuge manufacturers. We will have this installed by January 1987.

Mr. LEE. You start that installation in September, 1985?

Mr. LONGENECKER. We put the first one in last November, and there are about 500 installed. You will get the first beneficial production in late 1985.

Mr. LEE. What is your estimate of the cost per SWU?

Mr. LONGENECKER. It is difficult to tell you without defining the "baseline." It depends on the number you deploy, Bill, and how much of the total cost of GCEP you amortize.

Mr. POTTER. You can't give a range?

Mr. LONGENECKER. It is an extreme assumption.

Mr. LEE. Well, remember, you have $2 billion hanging out there you spent, right?

Mr. LONGENECKER. Yes.

Mr. LEE. What other costs are associated with a half million SWU's per year?

Mr. LONGENECKER. Incremental cost is what you are looking for.

Mr. LEE. Yes, above and beyond anything associated with the $2 billion.

Mr. LONGENECKER. On an incremental cost basis, I am going to estimate $80 to $90 just incremental cost of operating the Set III machines, if you assume that the capital is sunk.

Dr. **Bohn**. How much are the machines themselves in dollars per SWU per year?

Mr. **Longenecker**. Again, that is a sunk cost in the calculation that I just gave you.

We are going to have the centrifuge manufacturers who describe their actual cost experience, and that again depends on how many you build in the learning curve, and I would prefer to defer that, if I could.

Mr. **Lee**. Well, then, let me ask you this. You are on the track for a half billion worth. You have a half million SWU capacity per year. Regardless of your May 1985 decision, what are the economics of running that, as opposed to walking away from it?

Mr. **Longenecker**. It is a question of what we are comparing it with, and that has to do with how cheap is the marginal cost with some of the lower cost power that is produced for the GDP's and what is the lowest marginal cost that we can achieve by installing the rest of those Set III's. We haven't come to that conclusion yet. It is based primarily on inputs yet to come on the price of the power and the marginal costs of the gaseous diffusion plants. We will not have bought all those machines or delivered or installed all of them by the May 1985 technology selection.

Mr. **Lee**. What do you mean by all of them, for one half of one building?

Mr. **Longenecker**. Yes, sir. That contract extends through February of 1986. That is when we will have produced the last machines. So what we need to do is at that point in time, we would look at the cost of completing the Set III fabrication versus terminating the contract with the centrifuge manufacturers, and then the cost to install those and operate them and take that number and compare it against the best marginal cost we had in the GDP and decide whether to do it. I can't give you an answer on that.

Mr. **Mead**. Are there 3,000 machines involved?

Mr. **Longenecker**. The 2,880 is what there is in applicability, 120 toward cascade and 720 to a train and eight trains to a building.

Mr. **Lee**. All right, thank you.

Mr. **Longenecker**. It could be attractive. I don't want to be nonresponsive. It could be an attractive proposition on a marginal cost basis, but it is a highly complex calculation. It depends on the termination costs of producing machines and the overall operating costs of operating half a building. Obviously, keeping the operators around and training them is very high, and the more machines you spread it over, the lower the incremental costs.

Mr. **Lee**. But aren't there centrifuge plants in service in the world now at one-half million SWU's per year or thereabouts?

Mr. **Longenecker**. The Japanese have one that is in that range. Their Ningyo-Toge plant is about that size. URENCO has about a million on line right now.

Mr. **Lee**. In one place?

Mr. **Longenecker**. No, it is in two locations.

The reason that the economics in that are not intuitively obvious is that their economics at URENCO are obviously influenced heavily by rate of exchange.

Mr. **Lee**. We understand that.

Mr. **Longenecker**. The other factor is that those plants were designed to be that size. This was designed and was initially constructed to be 8.8 million SWU's and now what we have to do is go back and do the marginal economics of operating now as a 550,000 SWU plant.

Mr. **Lee**. Is that work going on right now?

Mr. **Longenecker**. Yes, sir. It can be economical, but it is not intuitively obvious under all circumstances, but it could be.

Mr. **Lee**. Thank you.

Mr. **Kiser**. You have in your folder one plan of the original GCEP plants that had eight buildings and 8.8 million SWU's.

A few years ago we upgraded that to 13.2 million SWU's in eight buildings.

If we proceed with the advanced machines, we will only need four to achieve the 13.2. These auxiliary facilities, you can't see very well but perhaps they will show up later, are all in place.

The plants that exist today is two full buildings constructed, the feed and withdrawal plant, the switch yard and the sanitary water and processed water, all those auxiliaries are in place, the recycle and assembly building. It is in this building that we will be installing one-half building of Set III's. The outline of those buildings on a site basis, we divide the plant into eight sections we call trains.

Each section contains six cascades. One cascade is 120 machines. The picture I use of CPDF is here.

Inside the building, where we are today, this is one part of a building. This part of it you can see the service modules where the processed gas, electrical and all the supporting utilities are in the lower parts. You can see the installation of the machines. We have today about 500 machines installed.

Here is a little better picture. The cascade that we are operating is there. It was started up in May of this year. The piece of equipment on this transporter that we carry machines from the recycle assembly buildings to process buildings.

On the cost and schedule status, the eight building base line cost is $6.8 billion. That references the original plant. The total operating cost has been stable since the beginning with the exception of adjusting for inflation and two programmatic schedules that took place. I think the point that all buildings have been built and projected to expand beyond where we are now would be the extension of additional buildings.

Construction procurement has been on a fixed price basis. We have a good basis for estimates. The Set V machine costs are subject to the features of new design, but the cost experience that we have had is relevant, and you will hear more about that from the CM's who will follow shortly.

We think the maintenance of the cost schedule is due to three reasons: One, we have a very disciplined project structure and project manager, tech engineer, systems support manufacturer, machine manufacturers, construction manager at the Portsmouth site.

We have quite a variety of well-known people helping us. Contractor Martin Marietta and process design support, research and centrifuge, Goodyear you have heard from, Catalytic for the site work, Bechtel for the RA facility design, and on down the line.

Mr. **Mead**. You have three machine manufacturers all building the same machine?

Mr. **Kiser**. That is correct, in equal quantities.

Dr. **Bohn**. No cost competition? It is just straight equal quantities regardless of cost?

Mr. **Kiser**. Cost plus fixed fee. We are in the early stages of procurement. The phase 1 procurement will be for one-half building. Beyond that, we don't have a firm procurement plan yet, but we will introduce competition at that time.

Mr. **Longenecker**. This is another one of those instances of being in the middle of a project and changing course. We had originally eight buildings between 45,000 and 50,000 machines, so the original thought was, back in the 1970's, I understand to begin producing quantities with three suppliers to maintain competition and have them produce a certain amount all the same, and then before you went into the large-scale production and ramped up, you would compete based on price.

Unfortunately, before we ever got to the point of having produced that many machines, we had a better machine and are now rebase lining the project. So much of what you hear is the transition over the next 8 or 9 months from the old project logic to the new.

Mr. **Kiser**. Another feature that has been important in maintaining the schedule and cost is a very disciplined project control system.

Project management plans, configuration control, cost schedule control, interface control, particularly in the program where we have the number of contractors that we have in the phase control system. Those are all features that have led to the success of the schedule I have described.

Continuing future activities we touched on. Today we are downscoping all activities for Set III efforts not applicable to operation of the first half building of Set III machines or to Set V. We talked about the first half building with Set III machines, the first train throughput. This is producing enriched uranium by Septemer 1985.

And in summary, the centrifuge technology has been well proven over the 14 or so years of the program. The management tools for the GCEP project are well in place. The project is well along. Machines have been qualified and are being produced. We have had very good performance on the project. We have startup activities that are progressing. Those activities are in your chart.

I won't repeat them, except to use the chart that shows the project site layout to indicate by the color green the parts of the plant that have been taken over by the operating contractor.

Green is Goodyear and in brown are the parts that are still unconstructed. The operating contractor is taking the facilities over as they are completed. All of the auxiliary facilities have been completed and are taken over. We will be producing SWU's in September 1985.

Mr. **Longenecker**. Mr. Chairman, another important part of the success of this program that has been alluded to earlier is the success of the industrial contractors in being able to develop the centrifuges and produce them in large quantities reliable at a low cost.

So one of the key players in that, of course, is the centrifuge manufacturers and to wrap up the GCEP description, I would like to have Dick Grant, who was one of the presidents of the Boeing division, describe the program and the experience to date.

Mr. **Grant**. You have now heard there are three fairly sizable companies involved in the manufacture of the existing Set III that we talk about and also in the development of the Set V and the manufacture of Set V hardware.

This chart presents it in a little different style perhaps. What is shown here is the sequence over time of cumulative machine deliveries and SWU's produced from those machines.

The number of the machines are a little over 2,000. The quantity of SWU's produced is approaching 200,000 over this time with machines of various configuration.

There are three companies that make up the group. My company, which is the Boeing Engineering Co., the Garrett AirResearch Manufacturing Co. and the Goodyear Aerospace Co., and I am speaking for all three of those folks today. All three of our companies have put together organizations specifically charged with doing the centrifuge work and reporting at fairly high levels, as you can see on this chart.

Our chairmen, all three of our companies, as well as our presidents, have been involved in the early commitments made to this program and subsequently in the conduct of the program and its progress. As an aside, one of the requirements to qualify to bid on the RFP that was let in 1979 were that you go to your board of directors and obtain from them a resolution committing the resources, capital, facilities and people for phase 1 as well as to go on into phase 2 and supply those same resources if selected.

By the way, there was a competition in the sense that there were four of us competing for three slots in 1979. Exxon was the other player in the game in those days.

We have responded to those requirements in a number of ways I will tell you about in a minute. The contracting sequence that we are all dealing with and that we are all having to deal with, our corporate boards, with these days goes something like this. Both what started it, where it went and where it looks like it is going now, assuming success on the part of the technology obviously.

I should mention on the previous chart, too, that we are pretty sure we are building awfully reliable centrifuges and the centrifuge plant demonstration facility, I believe, has proven that. We are also pretty sure we are building pretty cost-effective centrifuges, and I will show you a little more aout that as it goes along.

Mr. **Mead**. The last three bullets are contingent on this decision?

Mr. **Grant**. Right.

I will call to your attention that there is an overlap on that previous chart between the end of Set III production and the start of Set V production. I will show you why that is an important adjunct to the program as well.

We have all provided property real facilities and equipment to the program. This is a picture showing the photographs of the actual facilities of the three suppliers. Actually, in this plant they have an additional plant in addition to the Sandusky facility, which isn't shown on that picture.

What that has meant in terms of commitment on the part of our companies is shown in this chart in terms of the size of the sites and facilities and things we have available. Most importantly probably is that there is almost $170 million that is invested, private money, front ended, all this for the Government and we don't charge them interest, which is a fairly high-risk sharing kind of position we are in from a normal——

Mr. LEE. You say your company, Mr. Grant, has $70 million already spent?

Mr. GRANT. Yes, sir. In facilities——

Mr. MEAD. That the Government is not being charged for?

Mr. GRANT. We, of course, amortize it and depreciate it, but there is no interest on that money.

Dr. BOHN. Are you doing independent design work or are you all working from a common design?

Mr. GRANT. We are of course building a common design. In Set V we are doing collaborative but independent design work and developmental testing.

Mr. POTTER. How many years do you amortize it over?

Mr. GRANT. Depends. It is cast 409. Expendable equipment is 7 years, buildings 25 years, that sort of thing. Another important feature was, as you can imagine, we could not go to our boards and get a commitment for phase II without giving them some idea of what they were buying into for phase II.

The numbers you see at the bottom on phase II commitment are what each of us told our boards they should look forward to in case we won phase II. Advisable amount as well. You can't run a program of this complexity without a subcontractor vendor base that is large. It is large. It is in place and it is doing a good job. Their requirements are in some cases not unlike ours in terms of having cleared people for security reasons, as well as requiring cleared and closed facilities to build some of the things they supply to us.

Small disadvantaged business base is very good. There are only, I believe, 7 States in the Union, lower 48, that don't have some kind of business on the centrifuge program. As far as machine deliveries, we are talking Set III machines now. We deliver them as a collection of subassemblies and components which are subsequently assembled at Portsmouth.

In terms of quantities of those end items, about 10,000 have been delivered. This is now typical for each of the three of us. Out of 16,000 that will be delivered in the phase I contract, or something like 560 total machine sets out of a total of 962 plus spares we will deliver. The schedule costs we are on right now for Set III machines are on the track to meet the total estimate of completion that the Government had in place when the phase I program was presented.

As we build machines we have gotten better at it, needless to say. This, of course, is why the first machine is very expensive and the last one is less expensive. And what the cost of the machine is is so much a function of how many you are going to build?

Mr. MEAD. What percentage learning curve?

Mr. GRANT. Eighty-one and a half percent. That is for all the parts taken together, machine parts, assembly operation, the whole thing.

Dr. Bohn. Is that collective across all three manufacturers or each one individually?

Mr. Grant. This happens to be my own data, because we have direct access. The others are very comparable.

I would like to say they are not doing as well, but I can't. The learning curve theory is something we live by in this business, in all of our businesses at Boeing, and all of Larry's businesses, too, I'm sure. It is a discipline we live by. It is a management tool, an estimating tool and it is the way we get our raises and things like that as well by either making it or not.

Learning curve technology or theory or art or however you choose to see it, there are some pages in our book there that I won't go over that tell you a little bit more about it. But let me say that what we have now is a system that is very disciplined.

We know exactly how to predict what the cost of the next block of machines will be. Of course, we know exactly what will happen, also, if we disrupt a mature manufacturing program. That is a very clear thing that we know now. Mature well-managed manufacturing programs don't like to be disrupted.

When they are, they reward you with higher costs every time and predictably and fairly predictably in terms of the quantity of that reward. This is the actual learning curve data, again, my own, Boeing, and the others have similar data. What I have chosen here is to identify a couple places where known disruption occurred.

Sure enough, it rewarded you exactly as you had expected. This, again, there is the 8½ percent curve we are on. This is our—what we are working to. We are there. We may beat the projection a little bit by the time we get to our 962 machines or so. It's in pretty fair shape.

Let me give you another view that. Let's say that we are talking about 10,000 machines. If we can stay on that learning curve, that is the kind of performance we will have. Now, we know we can't keep 81½ percent going forever. This is a 90-percent curve from here to there. This again is a predictable attribute of programs with large quantities of things.

If someone should decide we should stop building Set III and wait around until—wait around for the Set V's to start, we will be rewarded exactly as I told you. And this sort of thing would happen at the start of Set V.

Mr. Lee. All right, Mr. Grant, let's come to the hypothetical situation that there are no Set V machines. You are delivering your last Set III machine in February 1986.

Mr. Grant. Yes, sir.

Mr. Lee. Would Boeing have an interest, today, in making a proposal to Duke Power Co. for, what are these machines, 200 SWU's each?

Mr. Grant. Set III, 200 SWU's per year; yes.

Mr. Lee. Would you have an interest in proposing to Duke Power Co. a thousand Set III machines?

Mr. Grant. Sure, we will build you a thousand Set III machines.

Mr. Lee. How much would you charge for them?

Mr. Grant. You are going to take this thousand in here?

Mr. Lee. I am assuming——

Mr. **Grant**. If you take that thousand they will cost you on the order of 75K a copy.

Dr. **Bohn**. Which is how much per SWU.

Mr. **Lee**. 75K, divided by 200.

Mr. **Grant**. $375 an SWU, I believe, per year, for initial cost.

Mr. **Lee**. Yes.

Dr. **Bohn**. That is just the machines. No building, no support.

Mr. **Grant**. Right. Something like that.

Mr. **Lee**. No plumbing.

Mr. **Grant**. Yes.

Mr. **Mead**. Just machines.

Mr. **Lee**. What is the rest of the plant cost?

Mr. **Grant**. That part I really can't answer. I am sorry.

Mr. **Longenecker**. Machines were between 40 and 50 percent of the cost of the total construction completion, on the first eight.

Mr. **Grant**. The average is going to cost you about $300 per SWU per year out here. If you wait until I have 1,000 Set V's to sell you out there, it will cost you about a 100 dollar per SWU initial cost.

Mr. **Lee**. All right.

Mr. **Grant**. Can we do that transition, you bet. I can't talk about a lot of it because there is so much classified material, but we have looked at every single subsystem. The Set V is being built today in my facility at Oak Ridge on the equipment at Oak Ridge by the people that work in that facility.

We have made an estimate of the total changeover. It is less than $5 million to change that facility over from the current rate of Set III's to Set V's. Summarizing, I hope I have told you that we have mature facilities and work forces in place. They are doing a good job, very respectable curve. Vendor and supplier base is in good shape. Doing a real good job.

Learning curves are great. We think we can convert to Set V very easily and without great disruption if we can keep it going. If we don't, there is a penalty.

Mr. **Mead**. What is the cumulative cost of that——

Mr. **Grant**. $100 million.

Mr. **Mead**. What?

Mr. **Grant**. $100 million.

Mr. **Mead**. Between those two the cost of the disruption is $100 million?

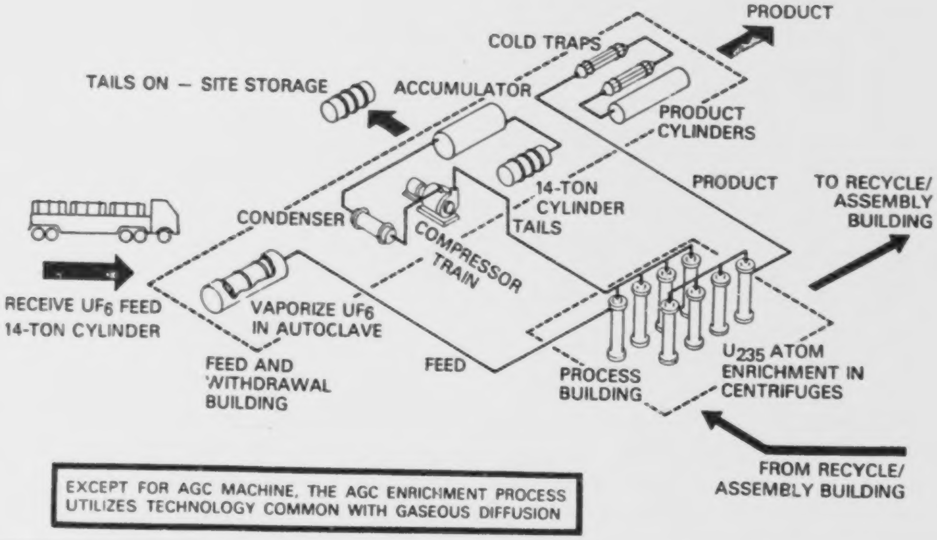
Mr. **Grant**. About what you have got in here.

Mr. **Lee**. All right, Mr. Grant, thank you.

Now we have scheduled a presentation on advance gas centrifuge technology. There were three speakers scheduled: Mr. Sommerfeld, Mr. Rowan, and Mr. Whitchurch. Can one of you gentlemen speak for all three and wrap it up in 15 minutes?

S-1

THE CENTRIFUGE IS ONLY ONE ELEMENT...

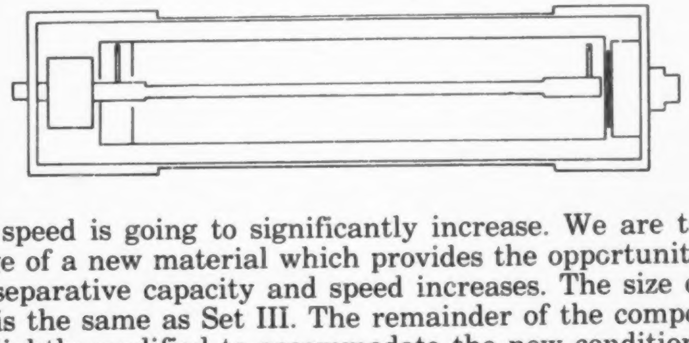

PRODUCT
COLD TRAPS
TAILS ON – SITE STORAGE
ACCUMULATOR
PRODUCT CYLINDERS
14-TON CYLINDER
TAILS
PRODUCT
TO RECYCLE/ ASSEMBLY BUILDING
CONDENSER
COMPRESSOR TRAIN
RECEIVE UF6 FEED 14-TON CYLINDER
VAPORIZE UF6 IN AUTOCLAVE
FEED AND WITHDRAWAL BUILDING
FEED
PROCESS BUILDING
U235 ATOM ENRICHMENT IN CENTRIFUGES
FROM RECYCLE/ ASSEMBLY BUILDING

EXCEPT FOR AGC MACHINE, THE AGC ENRICHMENT PROCESS UTILIZES TECHNOLOGY COMMON WITH GASEOUS DIFFUSION

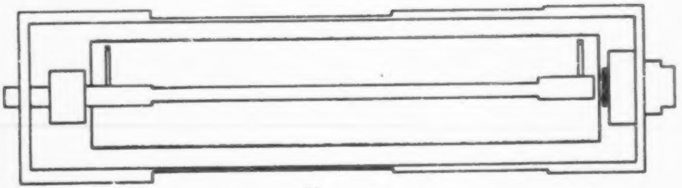
Mr. SOMMERFELD. I'll try. Here are your copies. I have 14½ minutes left. Very quickly, what you have here is the centrifuge process. There is one point I would like to make. I am going to be talking about AGC machines. Everything in this part of the process is in place at GCEP and is really a process that has been used in gaseous diffusion for almost 40 years.

So the thing to recognize in AGC is the single element of the AGC machine utilizing a technology base that has existed for many many years. We are not building a whole new enterprise. When we look at the comparison of the two machines that we are talking about, Set III and Set V, we see that the separative performance is going to significantly change by a factor of three.

COMPARISON OF SET III AND SET V CENTRIFUGE DESIGNS



SET III	FEATURE	SET V
200	SEPARATIVE CAPACITY (SWU/YR)	600
SET III	SPEED	SET V
SET III	ROTOR DESIGN	MODIFIED/ADVANCED MATERIAL
SET III	ROTOR LENGTH/DIAMETER	SAME AS SET III
MAGNETIC W/FORCE BALANCE CONTROL	UPPER SUSPENSION	MAGNETIC W/ELECTRONIC CONTROL
EXTRUSION	COLUMN	EXTRUSION
CONSTANT THICKNESS	CASING	STEPPED THICKNESS
SET III	ROTOR END CAPS	MODIFIED
SET III	SCOOPS	HIGH SPEED DESIGN
HYSTERESIS	MOTOR	PERMANENT MAGNET
SET III	LOWER SUSPENSION	IMPROVED SET III W/ELECTRONIC CONTROL



ADVANCED MATERIAL MAKES POSSIBLE
INCREASED SPEED & PERFORMANCE

The speed is going to significantly increase. We are talking advantage of a new material which provides the opportunity to make these separative capacity and speed increases. The size of the machine is the same as Set III. The remainder of the components are only slightly modified to accommodate the new conditions. So it is really the advanced material in the first three cases that represents what is changing between Set III and Set V.

Mr. **Mead**. Roughly plug in compatible then?

CENTRIFUGE PERFORMANCE DEPENDS ON . . .

- LENGTH
- SPEED
- EFFICIENCY

Mr. SOMMERFELD. Yes. Yes. Now performance in the centrifuge, as you know, depends on length, speed and efficiency. We have already said that the length is being left alone, so it can be inserted indirectly into GCEP without any major modifications. So we are concentrating, therefore, these development areas.

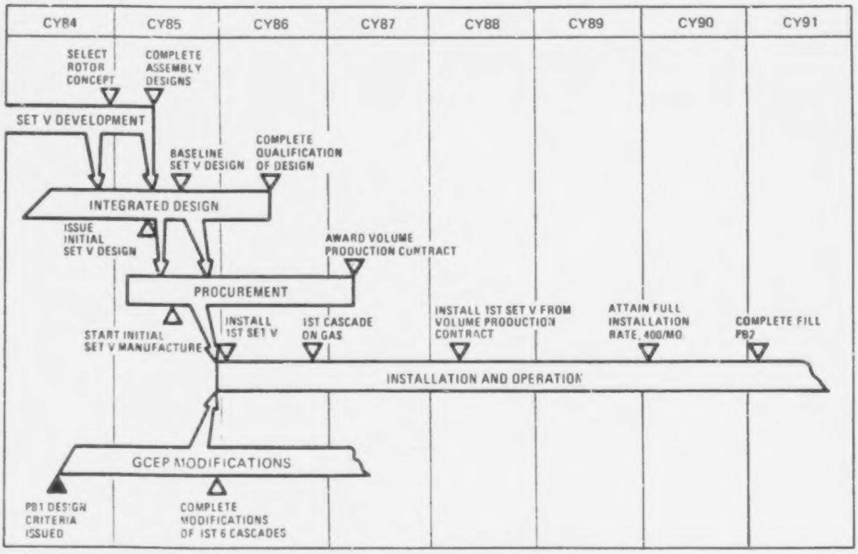
AGC DEVELOPMENT AREAS

- ROTOR TUBE MATERIAL & DESIGN
- END CLOSURE
- SCOOP DESIGN
- SUSPENSION DEVELOPMENT
- INVENTORY MANAGEMENT
- FLOW MANAGEMENT

WITH ROTOR LENGTH UNCHANGED PERFORMANCE GAINS WILL RESULT FROM SPEED & EFFICIENCY IMPROVEMENTS

The first four, which are really speed related, the fact that we have new material allows us to do many things with the rotor tube, end closure system, including better scoop designs, and suspensions to operate at much higher speeds. The remaining two items have to do with the gas inventory that we will put in this machine to gain efficiency.

AGCEP PROGRAM OVERVIEW


CY84
CY85
CY86
CY87
CY88
CY89
CY90
CY91
SELECT ROTOR CONCEPT
COMPLETE ASSEMBLY DESIGNS
SET V DEVELOPMENT
BASELINE SET V DESIGN
COMPLETE QUALIFICATION OF DESIGN
INTEGRATED DESIGN
ISSUE INITIAL SET V DESIGN
AWARD VOLUME PRODUCTION CONTRACT
PROCUREMENT
START INITIAL SET V MANUFACTURE
INSTALL 1ST SET V
1ST CASCADE ON GAS
INSTALL 1ST SET V FROM VOLUME PRODUCTION CONTRACT
ATTAIN FULL INSTALLATION RATE, 400/MO
COMPLETE FILL PB2
INSTALLATION AND OPERATION
GCEP MODIFICATIONS
PB1 DESIGN CRITERIA ISSUED
COMPLETE MODIFICATIONS OF 1ST 6 CASCADES

THE AGCEP PROGRAM IS COMPRISED OF 5 MAJOR AREAS OF ACTIVITIES, EACH WELL-DEFINED AND INTEGRATED TO ASSURE THE MOST EFFECTIVE DEPLOYMENT OF THE SET V CENTRIFUGE INTO GCEP

We have in place a well-defined program network comprised of five major areas of activity, AGC Set V development program, integrated design program, a procurement program, which takes off on that, the installation and operational program at GCEP and supporting that, the enginering design modifications which are nearly complete for the GCEP facility to accommodate the AGC.

Each of these areas, of course, is backed up by a much more detailed chart which I won't go into at this time. Now, what will we put on the table for the Process Evaluation Board in May of 1985? We will demonstate the mechanical performance, the speed capability for Set V operation. We will demonstrate also the capability to operate the machine on gas. Obviously, if you can't load it up, it is not worth a great deal.

AGC WILL PROVIDE GOOD INFORMATION FOR DECISION

- SPEED CAPABILITY/MECHANICAL PERFORMANCE
- CAPABILITY TO OPERATE ON GAS
- COST EFFECTIVE INTEGRATED DESIGN
- DEMONSTRATE POTENTIAL FOR 600 SWU/YR
- POTENTIAL FOR SWU PRICE LESS THAN HALF OF CURRENT PRICE

PROGRAM OBJECTIVES & STRUCTURE WILL PROVIDE A QUALITY BASIS FOR THE DECISION

We will demonstrate the cost effective integrated design and the potential for 600 SWUs per year performance. We will show very clearly by economic analysis that this has a SWU price potential less than half the current price. The program objectives and structure are designed to achieve those results.

Mr. **Mead**. What do you mean by potential for 600?

Mr. **Sommerfeld**. It may be that the most economical that the machine—machines, actually operated in the later part of the testing stage will not be fully optimized. And so in terms of actual performance data coming off those machines in that timeframe, they may be slightly different. But there is an optimization process that you go through in terms of the gas dynamics that may stretch slightly beyond the decision——

Mr. **Lee**. Again, about the last bullet.

Mr. **Sommerfeld**. Yes.

Mr. **Lee**. When you say SWU price less than half of current price, first of all, is current price what we were talking about yesterday, $135?

Mr. **Sommerfeld**. Yes, sir.

Mr. **Lee**. Then SWU price for GCEP with Set V machines, would that include the 2 point something billion already spent?

Mr. **Sommerfeld**. Yes, it would.

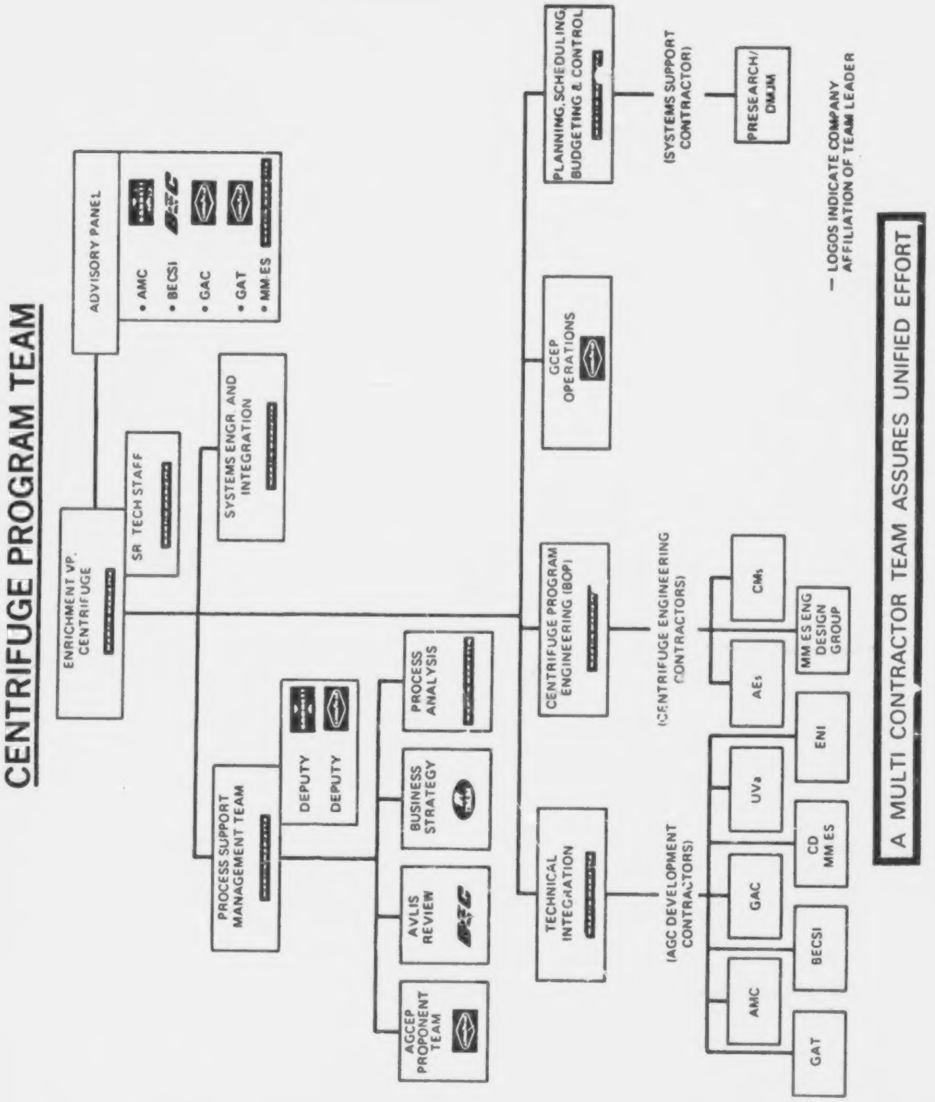
Mr. **Lee**. Anything else to finish—how many buildings, four?

Mr. **Sommerfeld**. We are currently thinking of a four-building facility and those costs it would take to put the total facility in place and we expect a SWU price of—SWU cost of $35 to $50.

Dr. **Bohn**. Can you give us breakdown of that, cost of the machines, cost of the building and support facilities, cost of the energy and operating costs?

Mr. **Sommerfeld**. Some of those data are here in various forms. When you talk about SWU costs there are a number of assumptions that must be spoken to. I have a view graph a little later that will touch on part of those assumptions. Maybe we can address that picture in a moment.

Mr. LEE. Let's focus on that as quickly as we can, can we?


CENTRIFUGE PROGRAM TEAM
ENRICHMENT VP. CENTRIFUGE
ADVISORY PANEL
• AMC
• BECSI
• GAC
• GAT
• MM-ES
SR TECH STAFF
SYSTEMS ENGR. AND INTEGRATION
PROCESS SUPPORT MANAGEMENT TEAM
DEPUTY
DEPUTY
PROCESS ANALYSIS
BUSINESS STRATEGY
AVLIS REVIEW
AGCEP PROPONENT TEAM
PLANNING, SCHEDULING, BUDGETING & CONTROL
GCEP OPERATIONS
CENTRIFUGE PROGRAM ENGINEERING (BOP)
TECHNICAL INTEGRATION
(SYSTEMS SUPPORT CONTRACTOR)
PRESEARCH/ DMJM
(CENTRIFUGE ENGINEERING CONTRACTORS)
CMs
AEs
MM ES ENG DESIGN GROUP
ENI
UVa
CD MM ES
(AGC DEVELOPMENT CONTRACTORS)
GAC
BECSI
AMC
GAT
— LOGOS INDICATE COMPANY AFFILIATION OF TEAM LEADER
A MULTI CONTRACTOR TEAM ASSURES UNIFIED EFFORT

Mr. SOMMERFELD. All right. An important part of the program is the fact that we are taking advantage through this structure, and the point here is the company logos. We have in place an organization using the best talent available from a number of industrial contractors, with major management commitment. As Dick Grant pointed out, that makes available to us the resources, the technology, the understanding, and the engineering to achieve this purpose.

This view graph, I think, very clearly illustrates that point. We also utilize selected participant roles. Martin Marietta is responsible for the program direction coordination, but different skills exist in different places.

PARTICIPANT ROLES

ACTIVITIES	AiResearch Manufacturing Company AMC	Boeing Engineering Company Southeast, Inc. BECSI	Electro-Nucleonics, Inc. ENI	Goodyear Aerospace Corporation GAC	Goodyear Atomic Corporation GAT	Lawrence Livermore National Laboratory LLNL	Los Alamos National Laboratory LANL	Martin Marietta Energy Systems, Inc. MM-ES	Presearch, Inc./Daniel, Mann, Johnson, and Mendenhall PI/DMJM	University of Virginia UVa
PROGRAM COORDINATION AND TECHNICAL INTEGRATION								X		
PROGRAM ADVISORY BOARD	X	X		X	X			X		
CENTRIFUGE DEVELOPMENT & DESIGN	X	X	X	X			X	X		X
CENTRIFUGE PERFORMANCE DEVELOPMENT	X	X		X		X	X	X		X
BALANCE OF PLANT TECHNOLOGY AND PLANT OPERATIONS	X				X			X		
SYSTEMS ENGINEERING	X				X			X	X	

PROGRAM ASSIGNMENTS MATCH
SPECIAL SKILLS OF CONTRACTOR TEAM

NEW TECHNOLOGY IS EASILY INCORPORATED

ROUTINE REPLACEMENT FACILITATES CONTINUAL UPGRADING

We are managing these actions, duplicating only in areas where it is truly important to the total program. The new technology is very easy to incorporate. As I showed you in the first view graph, the machine element is the only change. So we are talking about the opportunity to regularly, if necessary, introduce into GCEP an upgraded machine without changing the remainder of the facility. It is a matter of modifying interconnections.

Dr. BOHN. Then what was the purpose of making the Set III machines very reliable and very long life?

Mr. SOMMERFELD. The Set III machines were the original design for GCEP. They were selected prior to developments of the last few years in new materials.

Dr. BOHN. So we are now building over engineered machines from the point of view of current economics, since we figure we will want to replace them in a few years anyway?

Mr. SOMMERFELD. We are building machines that are economically attractive, but which can be superceded as a result of advanced materials with a machine whose performance is significantly better, like a factor of three.

And a machine will be available, we believe, confidently, in the next 9 to 10 months.

Dr. **Bohn**. So we would be better off building somewhat less reliable Set III machines if it saves us money?

Mr. **Sommerfeld**. Well, I think reliability is already in the Set III machine. It has been engineered, designed and being fabricated now. There is not much point in going back to attempt to undo that. You asked a question about cost. What are the factors influencing enterprise separative work cost? Obviously, any time you talk about this there is a host of assumptions, a host of things that I think John alluded to.

FACTORS INFLUENCING ENTERPRISE SEPARATIVE WORK COST

- ECONOMIC & MARKET ENVIRONMENT
- MIX OF GASEOUS DIFFUSION AND ADVANCED TECHNOLOGY
- COST OF ADVANCED TECHNOLOGY
- TIMING OF DEPLOYMENT OF ADVANCED TECHNOLOGY

You have the economic and market environment you are operating in. You have the mix of gaseous diffusion which you heard about earlier and this advanced technology. Is it exclusively one or the other, or a type of combination. The cost of the advanced technology and the timing of the deployment is obviously important, as you heard Dick Grant speak of.

We think AGC is very attractive because it provides the potential for SWU costs in the range of $35 to $50 and we are talking about SWU costs knowing a great deal about the process. We know what the construction costs are. We have an industrial base established that is used to build the current machine and the new machine is not significantly different with the exception of the new material.

Mr. **Potter**. Wait a second. Roger just asked you about that cost and derivation of that cost.

Mr. **Sommerfeld**. That is for a four building, $13.2 million SWU facility.

Mr. **Potter**. Thirteen point——

Mr. **Sommerfeld**. $13.2 million facility, four-building GCEP Set V machine.

Mr. **Potter**. Do you have a single piece of paper that shows the derivation of that number?

Mr. **Sommerfeld**. I don't have it with me. It is one that can be provided to you.

Mr. **Potter**. I don't want to come down hard on you in particular. But the basic—the basic thing we are talking about here is an investment decision. Do you think it is more important for us to see the program team, organization chart, than to see the derivation of that number in terms of making an investment decision?

Mr. **Sommerfeld**. I think we have assumed, maybe incorrectly, that the Process Evaluation Board, which is in place and which is charged with the responsibility of looking in great depth at whatever we say about economics and performance achievements, will indeed go into this. We recognize that the development program we have in place, although challenging, still has some achievements to make before we can totally validate numbers and explain in detail what each increment is.

These are case studies based on that part of the experience which is real, for a $13.2 million SWU plant, four-building GCEP using the engineering estimates and actual costs that have been expended, as well as those that we think are necessary to complete the facility, and taking into consideration what we think the testing program achievements will be.

Mr. **Lee**. OK, Ken. Does that ball park include interest on the total investment? Depreciation on the total investment?

Mr. **Sommerfeld**. No. No, I'm not sure of that. No, it does not. But we can furnish a list of the criteria to you, and the assumptions made, that relate to those numbers. I do not have that page or piece of paper with me.

Mr. **Potter**. Do you think that the capital costs, which Bill just asked about, do you think that is a relevant number for a panel like ours to incorporate into costs?

Mr. **Sommerfeld**. Yes, I think it is.

Mr. **Potter**. Maybe it costs a whole lot more in capital costs here than the other. That is what it understands the theme of the next presentation might be. You didn't bring any information on that?

Mr. **Sommerfeld**. I did not bring a view graph on that. I have some—you know, we know what has been spent so far.

Mr. **Potter**. How much per SWU at 10 percent?

Mr. **Sommerfeld**. I do not have a detailed breakdown of that. We can get that to you rather quickly.

Mr. **Longenecker**. The problem is you are asking questions of the person developing the technology. What we are trying to do in these 2 days is describe both what it is we are measuring and tell you what we are doing. If we had the answer we would have made the choice between AGC and AVLIS already.

What you will hear next is how we are collecting the data and some of the considerations we are going to undertake between now and next April when we have a firm technical and economic data base. We can provide you—again in the limited 2 days it was difficult to choose whether we tell you about the program and what we are doing or go through the economics.

We try to do a little of both. We can provide additional information like that that you need.

Mr. **Lee**. The panel isn't interested in prejudging your May 1985 decision, John. We have some other information. We are just trying to get a feel for the viability of the enrichment process in this country as opposed to the worldwide competition.

Dr. **Bohn**. We are also interested to what extent the program is being run on—like a business, and to what extent it is still being driven by technology and engineering excellence as opposed to cost effectiveness.

Mr. **Potter**. I would think one of the things you would be bending over backward to demonstrate to this panel is that you are—that we should have confidence in you; that you are generating the information that will lead to the right decisions, because we are not going to make the decisions. And I don't know that anybody is going to read what we say, but the one thing that would be nice to go away with is solid confidence that the program is in good hands.

And I don't know if the approach so far has convinced me of that. We are talking about spending on the order, in just R&D alone, of $1.1 billion so far, enough to build 11,000 $100,000 single-family homes. And I have yet to see—and maybe I am missing it in this material, but I have been through it—one chart showing me the investment that you make and the returns from that investment.

Are there any charts like that?

Mr. **Longenecker**. We are going to describe for you later what we do with the data that both technical and economic, both of these R&D programs generate and how we do that analysis. We are not going to present to you an investment analysis today.

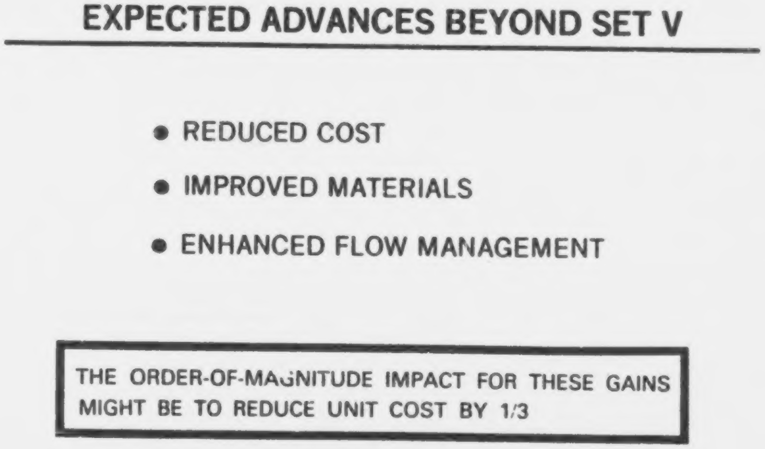
Mr. **Potter**. In all this material there is nothing that says you invest, let's say, for option A, maybe option B and C you invest $1,000 and you get 40 payments of this. You invest a $1,000 here and you get 40 payments of this. Nothing like that; is that true?

Mr. **Longenecker**. That is correct.

Mr. **Lee**. OK, Fred, we understand.

Mr. **Longenecker**. That is the process we are going through. If I had that done, we will have it next May.

Mr. **Lee**. Before congressional committees convened this panel, you didn't pick the timing. Maybe all this information is not ripe yet. Ken, what highlights do you want to cover?



EXPECTED ADVANCES BEYOND SET V

- REDUCED COST
- IMPROVED MATERIALS
- ENHANCED FLOW MANAGEMENT

THE ORDER-OF-MAGNITUDE IMPACT FOR THESE GAINS MIGHT BE TO REDUCE UNIT COST BY 1/3

Mr. **Sommerfeld**. Two other comments: there are several expected advances beyond Set V in three categories: reduced cost, improved materials and significantly enhanced flow management that over the opportunity of cost reductions or gains of approximately a third.

Mr. **Mead**. SWU costs, I assume?

Mr. **Sommerfeld**. Yes. In conclusion, we think AGC has the potential for keeping SWU price low, and it is an efficient use of energy. It has the potential for substantially enhanced economics, and it can be accommodated direction into GCEP. We have a well-structured program, and we are in the process of working on some of the economic considerations and factoring those in, as you asked about earlier.

Now I would like, if Mr. Rowan and Mr. Whitchurch could allow me, to make a couple brief comments about what they would have told you.

Mr. **Lee**. I think I will change the ground rule and call them. I appreciate your being here, Mr. Rowan and would you have a few remarks for the committee? Then I will call on Mr. Whitchurch. Again, Ken, you did a good job. You stuck within 15 minutes in spite of our interruptions. Thank you.

Mr. **Rowan**. Thank you for the opportunity to speak just a few minutes, too, Mr. Chairman, and the panel. Again, my portion of the presentation was intended to give you a very quick overview on the P-3 program mostly from a developmental standpoint and its expected readiness.

I think the main point in the few moments I have available that I would like to emphasize with you is the maturity of the process over all, whether from a development standpoint and knowledge base that the centrifuge people have about its technology or whether we are speaking to the production aspects of it.

Set III and the prior models have produced 163,000 SWU's to date. That is in sharp contrast, of course, to the fact that the competing process has not yet produced one SWU. It is intended to do so before the year is out and the AGC itself hasn't yet produced one SWU. Both of those very important demonstrations are scheduled to occur the first quarter of next year.

But it is very comforting for the centrifuge people to know we have that kind of a pedigree behind us. You heard different numbers on centrifuges manufactured. That has to do with the variability of units in storage versus those at Portsmouth. Dick Grant gave a number of 2,000. It is in that range depending on where you want to look at the inventory.

Machinery reliability goal in Set III has been achieved and in fact exceeded. Our labor learning in all three establishments has been excellent. It has been better than 80 percent. Again, emphasizing that each centrifuge is an independent unit of SWU production, when we get through with the initial stages of development and demonstration on the Set V machine, we will know whether or not it can separate uranium isotopes and we will know what kind of SWU performance on record will be there.

We will also be able to extrapolate if it is necessary to do so as to whether or not we will meet—exceed the 600 SWU limit and probably when. The machine itself will be readily integratable with the balance of the plant. As you have heard throughout the presentations today, there are many other components and features of a plant system, the centrifuge to balance of plant integrations, already been successfully accomplished on Set II and we expect it to be very easily done as well on Set V because of the work already undertaken.

So it is a proven performance record established at every level. Design, engineering, production, and operation, very high degree of confidence that we are going to meet our objectives. That confidence is born of the history of the program and success record that it has enjoyed to date. Development and demonstration work is progressing very well.

Future product improvements Ken alluded to earlier for production are readily feasible. Production transition, Dick Grant touched on that. It is straightforward. It is already well defined and we expect it to track the established Set III record. In the infrastructure of the centrifuge manufacturing community represented by Boeing, Goodyear, and Garrett, it is a complementary technology and CM based.

That, coupled with the existing base to date, we think provides added assurance of success here.

Mr. LEE. Thank you. Garrett, among the three manufacturers, you have the lowest initial investment in phase I, some $38 million.

Mr. ROWAN. Yes.

Mr. LEE. If for some reason GCEP does not go forward, would you be in a position to manufacture some Set III machines for a private company?

Mr. ROWAN. Indeed, sure. Yes.

Mr. LEE. The fact that you have lower investment, does that mean your production facilities are more labor intensive, less capital intensive and therefore less efficient?

Mr. ROWAN. They have cost less capital. All three manufacturers have comparable rate capacities, give or take a few machines per month. They are essentially equal right now so the answer is that we would be able to do that.

Mr. POTTER. How long do the machines you produce last? What is their useful life?

Mr. ROWAN. The reliability numbers in the program are classified numbers, Mr. Potter. However there is a figure of merit used in the program that approaches the answer to the question that you have raised here. That is called equivalent length MTBF. That is kind of a composite number that takes into account both reliability and maintainability.

I believe the goal established for the CPDF as well as GCEP was something like 3.5 years and in the CPDF facility which was shut down and commented on earlier, it was something of the order of 4.3. So it has been doing its job.

Mr. LEE. The machine is repairable.

Mr. ROWAN. Yes, indeed.

Mr. POTTER. If it is $100 original cost and we get the 4-year—four point what?

Mr. ROWAN. 4.3 was demonstrated.

Mr. POTTER. About 4.3 years, then we have to do something to it; is that right? So, first it costs $100, we will say. When we get to 4.3 years we have to do something to it. How much will that cost, doing something to it?

Mr. ROWAN. I don't think I could answer that question for you.

Mr. Lee. Is it $10 or another $100?

Mr. Rowan. I don't really know that number. But maybe a way to approach the answer to that would be to say, look at the severity cost of failure, severity involved with the failure. It has been extremely low for all of the P-1 machines produced to date on it. I can't really convert that to a SWU cost for you, but none of the machines have any really serious failures in the CPDF.

I think it was one or two that had a rotor failure on it.

Mr. Potter. Let's say you had to guess. Let's say that the $50 we heard about a little while ago didn't include any of this maintenance cost, let's just say. Do you think it would add another $5 to the SWU's, or maybe $50 maintenance cost?

Mr. Rowan. Probably down on the lower end, Mr. Potter.

Mr. Potter. 50 cents? $5?

Mr. Rowan. We will take the $5. I don't really have a basis. As alluded to earlier, it is a very complex kind of modeling operation to give that kind of an answer to you off hand. You would have to look at the total enterprise costs.

Mr. Longenecker. I think we have here a copy of the breakout between each of those which tells you percentages for machines, operating, maintenance.

Mr. Potter. Let me just ask one more question. After the 4.3 years and you do something to it, can you keep doing something to it? For 20 years?

Mr. Rowan. To get to the 4.3 you do something to it. There is a maintainability regime adopted for machines, preventive maintenance, and so forth.

Mr. Potter. The machine keeps going after 4.3, can go out to 20 years?

Mr. Rowan. Yes; the life of the machine is probably on the order of 20——

Mr. Grant. I believe we can say that the factor on the 4.3 for a high cost failure, not $100 or $300 failure, but a high cost failure, is a whole bunch of factors times the 4.3 and probably measured in decades.

Mr. Lee. Mr. Rowan, thank you very much.

Mr. Whitchurch, we thank you for coming.

Mr. Whitchurch. I will be brief, Mr. Chairman. I am going to talk about cost reductions that the centrifuge manufacturers have effected and we mean quality in the broadest sense, from design technology to when the product goes out the door. It starts with a management commitment to quality we have all made. Every day our words and deeds have to be consistent with our objectives to do it right the first time, and make quality come first so that when those machnes get out there they operate reliably and with minumum maintenance and operating costs.

We have some quality initiatives I would like to talk about which are directed at utilizing the fullest potential of our people. Proper environment—at Goodyear Aerospace this is an employee involvement program whereby all employees, both hourly and salaried, are treated with trust, respect and concern for the individual.

Everyone is encouraged to get involved in our operations, give us their ideas and where we can effectively use them. On the logo there the UAW stands for United Auto Workers, this philosophy has been developed in cooperation with them. Both the union and management are committed to this in the future.

This is the cover of our handbook, for instance. It was prepared by an employee task team not by management. We use training extensively. We regard training as an investment. The only training costs we are worried about is what it is going to cost us if we don't do enough training. We also use statistical methods, statistical process control. This is an analytical tool that enables us to first set up a process that consistently produces parts within tolerance, and then, by tracking that process it warns us when the process starts to go out of control.

We can take action before we do in effect produce defective parts. This, of course, is one of the tools that the Japanese are very good at. And the bottom line is better quality and lower costs. Then last, we are using certified operator inspectors, whereby, after being properly trained and certified, the operator will actually do his own inspection thereby he gets immediate feedback.

He knows, if he has a problem, he knows about it right away, not a matter of hours or days later when a second party inspector has discovered it. The emphasis here, of course, is to prevent defects before they occur, rather than suffer the horrendous costs of discovering defects after the part is completed and then you either have to repair it or whatever.

I will cut my presentation short. Thank you.

Mr. **Lee**. Thank you very much. We appreciate your coming.

Now we will turn to AVLIS. We have Mr. Davis.

Mr. **Longenecker**. Mr. Chairman, in presenting this, Jim is going to try to talk a little more toward the type of cost breakdown Mr. Potter has been looking for, increments of the overall production costs. I also have one here for AGC which I will give you that you can look at.

Mr. **Potter**. Fine.

Dr. **Davis**. I would like to make a couple introductory comments. You will note the bulk of the briefing has been oriented toward use of rotating machinery to enrich material. That started in the 1940's. It was our perspective in the early seventies that the way to reduce costs was to try to introduce some modern optics and electronics technology into this.

The real basis of the AVLIS approach was to try to introduce that type of technology and do this at lower cost, more efficiently, and so forth. The principal target was capital. Power has been solved to some extent by the centrifuge program in our view, but diffusion had both power and capital intensity. So we had not only to deal with the power probem to be competitive with the centrifuge, but also we had to deal with the capital problem.

So our focus has been on that from two points of view. One is the obvious one, if we continue the Federal enterprise of getting low capital cost is desirable or if we are going to do it in the private sector we had to get much, even much lower capital costs. It was our feeling we had to achieve capital costs as low as half a billion dollars to make it viable as a private business with raising money from a number of investors and banks without going into very high, you know, guarantees out of the Government.

Mr. **Lee**. Half billion dollars for the whole R&D?

Dr. **Davis**. Half billion dollars for an increment of production we felt was required. The Government's intention was to privatize at the time we started the program.

Mr. **Lee**. Our size of the increment for the half billion bucks?

Dr. **Davis**. We are working with it on Bechtel and Stone & Webster. Our estimate is 2 to 4 million SWU's for about a half billion dollars with a pay back time of about 7 years.

Dr. **Davis**. That is our current estimate based on those studies.

Mr. **Lee**. So your investment is $250 to $500 per SWU.

Dr. **Davis**. This is initial increment, yes sir.

Mr. **Lee**. Thank you.

Jim, go ahead.

Dr. **Davis**. So that was our primary emphasis on capital costs. Now, another factor that we put into our planning is that it isn't going to do us much good to have a process that can't compete entirely against the forward operating costs of the diffusion plants, so our feeling was that we had to have a process which could produce at a cost below the current world operating capacity.

I think the diffusion plants, whether they paid off their capital or not, at least they could run for short times and defer some of that payback, so we thought we had to compete against the factory costs only.

Mr. **Lee**. Let's see if I understand you. You are talking about a total cost of AVLIS that he calls the average cost out of diffusion?

Dr. **Davis**. Yes sir. We feel that we have to beat that. If we can't beat that number our feeling was then we can always be put out of business by any diffusion plant which is willing to just run at its marginal cost. So our objective is to do that and we feel that AVLIS is not worth probably pursuing, that this time if it can't do that. That is our position.

Now, technology we are interested in. We feel this is broadly applicable to other isotopes, materials processing in general. We are using it on other isotopes today for defense programs. We are looking at other applications with Sylvania, Westinghouse, and companies like that and we think modern optics and electronics are going to continue to grow worldwide. So those are the merits of our process.

Now, in the interest of time, I am not going to go through a lot of pictures that I put in the book. I thought the best way for you to get a feeling, since this technology may be a little less apparent to you than some of the others, was to put a number of pictures with some texts in the write up and you can look at that at your leisure and get a feeling for it.

The focus of our program at this point in time is on the construction of a facility that is in scale about a 1 million SWU facility and that is the production prototype system. And what I would like to do is skip to that and talk about that as the focus of my talk. I will skip over a number of charts to make up some of the time unless, of course, you would like to go through them, I will be happy to.

We have done functional integration of this process and that has been the activity over the past several years and I am showing in the background of this picture facilities for where lasers and separator systems exist.

In the foreground is the full demonstration facility. That facility—I will give you a status report on this. That is the purpose of this part of my talk. We have connected those two facilities with a 1 kilometer long pipeline so we can transmit the light over the existing half-scale separator facility. We are going to use the half scale facility for this 1985 selection. We will not be able to have the full-scale demonstration facility fully activated with this selection. That was our 1987 program, to have operated at full production scale.

Mr. **Mead**. But you had the light source?

Dr. **Davis**. We will have about 20 percent of the laser system activated and we will transmit that to the half scale separator and do whatever kind of demonstration we can within the time available.

This is the construction site as of about a month or so ago and on the left-hand side is the laser portion and on the right-hand side is the separator portion. There are a couple of annexes being installed outside of this for managing some of the parts and pumping dye into the lasers.

To take you inside the facility, there was a preconstruction model made of this showing the laser system on the left and the separator system on the right. The lasers are constructed in the following way. They are mounted on optical support structures.

This is a shot of the construction of the facility about a month ago and on the left-hand side you see a model of that. We are dealing with the human factors and how we put the lasers in.

This shows the life test facilities at Livermore and these facilities if we use two size copper vapor lasers in this. These are discharge tubes that produce the primary lasers and these are just for doing life testing.

We produce green light out of those lasers and transmit it through the facility and this is the way the facility is constructed. The green light energizes dye lasers and this gives us tunable light. Think of building an FM transmitter except we are doing it at optical frequencies instead of radio frequencies. They are essentially identical.

This is the dye amplifier shown here.

The full scale separation tank is about a 1 million SWU tank shown here. It is about 80 feet long and this will be installed in the facility about November. It is being built by Chicago Bridge & Iron, and it is a performance contract, fixed price.

This is a test facility at Oak Ridge. We are doing materials testing. This is a full-scale unit in diameter but not in length, but that is adequate because it can test individual parts.

Let me come back now to this full-scale demonstration facility that we are constructing. This is a photograph of that. The purpose of building this is that the AVLIS process is modular. We can construct it out of modules in the range of something like one half million SWU to 1½ million SWU.

Now, to show you how this compares with the production system, it would have several modules. The black lines show the overlay of the full scale demonstration facility in comparison to a multimodule AVLIS production plant, so we simply take a laser module, a separator module and replicate.

Dr. **Whittenbury**. What is the capacity of that complete plant?

Dr. Davis. This plant, when it would be fully activated, would have eight modules in it and in fully activated conditions would be about 10 to 13 million SWU depending on the exact assays.

Dr. Whittenbury. So that would be equivalent to a full building GCEP plant?

Dr. Davis. The full GCEP plant, yes sir, with Set V.

The purpose of this demonstration facility I believe—and I will skip that chart in the interest of time—but the purpose of the demonstration facility is to do all the things that you need to do before you do a production facility, obviously. So this simply shows in the most rapid deployment that we think it technically reasonable to the AVLIS program, how one would phase from the engineering of the full scale demo facility to the engineering on the full-scale production plant and so on down the line.

There are questions about how we make product and I will just mention that because it comes up often in briefing, is that what we do is we produce out of our separator unit product streams that are typically encriched higher than full requirements and then we blend to achieve the ultimate requirements of the power company.

That can vary anywhere from the nominal 3 percent to 5 or 6 percent.

Mr. Lee. Hold it right there. You show a tail stream of two-tenths of a percent.

Dr. Davis. That is the design. This plant would run somewhere in the range of 0.15 to 0.25 tails. That is what it is optimized to.

Mr. Lee. Well, AVLIS has the capability of going much lower.

Dr. Davis. Yes, sir. All we do is simply once we strip to the optimum in one stage, if we want we can refeed into a second stage and strip down again. We typically can take out about two-thirds of the material in a single stage, two-thirds of the uranium.

Mr. Lee. And this is not set for that. This is not a cascade process, it is a one-step process?

Dr. Davis. One step; yes, sir.

Mr. Lee. Now, for the sake of illustration, if all costs are $50 an SWU on this chart, how much per SWU would be the cost for taking our existing tails, two-tenths percent from 2,500, and stripping that on down to two-thirds of that, or to one-third of that?

Dr. Davis. I don't want to complicate this.

Mr. Lee. Is it $55 or $100?

Dr. Davis. AVLIS is actually cheaper on a per SWU basis to lower the feed assay. The reason for that is because of the way the throughput is controlled in that machine. The throughput is determined by essentially how many uranium 235 atoms are being removed. So if you have a lower feed assay, then you can increase the throughput of the machine proportionately. So what happens is our SWU costs actually decrease with tail stripping.

Mr. Lee. So what you are saying is that with this process, the enormous quantity of tails sitting on the ground in tanks out there that are accumulated for decades, all of a sudden is an important resource?

Dr. Davis. They have a book value I would say, even though they are not carried at any value on the books.

Dr. Bohn. What would the comparable cost per kilogram be?

Dr. DAVIS. Well, I don't want to mislead you here that we are talking about factors of three or something. We are dealing with sort of 20 or 30 percent effects. We are not dealing with big effects, like I said, factors of three or something.

Dr. BOHN. Presumably it takes more SWU's to take a 0.2-percent feed stream and get it up to reasonable enrichment levels.

Dr. DAVIS. It definitely does, yes, sir.

Dr. BOHN. So it would still be more expensive to use that feed stream than to use a standard feed stream?

Dr. DAVIS. Of course. The typical tradeoff is about $40 a pound equals about $40 an SWU, as I recall. So at this point, you are better off with stripped tails. You are paying $40 a pound for yellow cake and $40 for an SWU, so that is the breakeven point where you might switch over. So it is a detailed optimization depending on the price of the feed. You simply trade SWU's with feed and if feed costs go up very much, then you move to stripped tails.

You have to include a lot of costs in these things. This shows a site plan. We sited this as the Oak Ridge gaseous diffusion plant at the western edge of it and you see the AVLIS plant here and there are a number of other facilities like feed preparation, uranium recovery, product and feed conversion. We are using metal here to feed. We are assuming that we take UF_6 into our plant and ship UF_6 out, so we are burdening this process with those UF_6 conversion charges.

Dr. BOHN. That is 22 percent of your cost estimate?

Dr. DAVIS. I guess you moved ahead of me. Yes sir.

If we want to do that, that is what it would be.

Now, there is a proposal on the table for DOE that we should not do that with feed although we should do it with tails and most of the process of the feed conversion is in large quantities. I said tails and I meant product. Do you understand what I am saying is that right now we are converting from yellow cake through UF_6 to meet 58. If we were to go directly to metal with the feed, which doesn't affect the product's purity specifications, we think we could save $2 or $3 an SWU there.

Mr. LEE. And then on the output if your ultimate objective was to make UO-2 you would not go back to UF_6 would you?

Dr. DAVIS. Conceivably you could put that cycle together but the cost of going back to UF_6 is relatively small because the quantity of material is down by a large factor. It is 3-percent assay.

Mr. LEE. You are only doing it with the enriched product?

Dr. DAVIS. Yes, sir.

So these are our estimates for this plant. We have done it in a phased way. The righthand column is when the plant is wholly activated. That is the capacity range, the product range, the capital cost and the operating cost and when you go to that, that is a function of the marketplace obviously. So we are saying to get this into 13 million SWU is a total cost of $1.5 billion in capital and about $150 million a year operating. Now, we are refining these numbers. The reason I put these results on here is we are working with Bechtel and Stone & Webster right now and Martin Marietta Engineering, and we are going through the whole design and we do that every year and update our numbers.

Mr. **Lee**. But that chart suggests it your ball park judgment is $150 per SWU per year of the capital cost?

Dr. **Davis**. That is right, in the fully activated plant.

When you go to the smaller plants, you lose somewhat in economies of scale.

Mr. **Lee**. I understand, but the $1.5 billion divided by 10 million SWU?

Dr. **Davis**. Yes, sir; that is what we are saying.

Dr. **Bohn**. Let me ask this. You have that interesting number 6 years. Suppose you had already built the initial increment and kept your production lines open, how long would it take to produce each additional 1 million SWU per year?

Dr. **Davis**. Our estimate on capacity expansion is 2 to 3 years simply because of the way we would have to design the plant. If we separated the buildings entirely, depending on how much infrastructure we built up, you could maybe get that number down to a couple of years.

Dr. **Bohn**. What I am getting at is whether with this process you have a short enough leadtime that you could build plants to track contracts?

Dr. **Davis**. I think you could.

Now, this, by the way, should be called project time. The construction time is actually much shorter than 6 years, so it is the time of the project from the time it started.

Mr. **Lee**. What is the capacity of each of these modules?

Dr. **Davis**. In this design they are 1 million SWU and I indicated to you that the design flexibility is from a half to about a million and a half and some of the privatization schemes we have looked at, we are looking at half million SWU modules, because of some of the points that Dr. Bohn has raised.

Mr. **Mead**. The first increment has three modules?

Dr. **Davis**. Six modules. This is a capacity factor. There are six modules in the plant. That is the 5 million SWU's just because of the capacity factors.

Mr. **Potter**. Jim, the $1.5 billion shown in the right-hand column, that doesn't include the $1 billion shown in the left, does it?

Dr. **Davis**. Yes, sir, it does. That is the reason I wrote totals there. I expected that might be a point of confusion. This is the total. It is half billion to go from here to here.

Mr. **Lee**. That is $50 an SWU?

Dr. **Davis**. No.

Mr. **Potter**. You are going from 5 to 10?

Dr. **Davis**. No, I am trying to show you the way we are proposing to build our plant in increments. We will build a plant that will house the full 10 to 13 million SWU. We are going to initially deploy only this part of it. So we have paid for part of this plant already in advance, some infrastructure, so our total enterprise would be $1½ billion.

Mr. **Lee**. $100 an SWU for the increment?

Dr. **Davis**. Yes, sir, you could look at it that way as well.

We covered some of the infrastructure costs in the larger plant. I am sorry about that. It is a little bit misleading.

Mr. **Lee**. So what sort of team have you got really working on thes numbers between now and May?

Dr. **Davis**. Well, we have about 50 people from Bechtel.

Mr. **Lee**. Focusing on this?

Dr. **Davis**. On the whole plant issue with us, the plant design and costing numbers, and I don't know the number from Stone & Webster. It is probably 30 people or so under contract. We have people from Martin Marietta. The size of that team is probably 20 or 10. I don't recall the numbers off the top of my head.

Mr. **Lee**. You are from an national laboratory. What is your manufacturing infrastructure problem in making these?

Dr. **Davis**. What we are doing is that we are building a 1 million SWU facility right now and what we are doing is relying on an industry. I have some charts on that but I can address it directly. We are relying on industry to work with us on the integration and typically medium sized companies. So the level at which we maintain is the level at which we procure. So we can go out into industry and write these procurements and get a lot of them on fixed price performance contracts.

Mr. **Lee**. How about your flashlights?

Dr. **Davis**. I have a listing of suppliers in here. If you look at my briefing there is a vugraph on that. It lists suppliers of the separators, the laser equipment and the number of suppliers. Typically in every area——

Mr. **Mead**. You are buying effectively all the equipment?

Dr. **Davis**. Yes, sir, we are not making it.

Mr. **Lee**. You are saying that the manufacturing infrastructure exists in this country to support this program?

Dr. **Davis**. Yes, sir. The high-technology aspect of this process is in the process itself. The equipment, the electronics and optics is foreign to this industry—the enrichment and chemical industry—but it is not foreign to the aerospace and Silicon Valley and those parts of the country. This would be pretty routine technology.

Mr. **Lee**. On the output end, the metal casting, the front end, the vaporization, is that frontier technology or is that put together from the hardware store?

Dr. **Davis**. Well, you don't put the collector together from a hardware store. That is something that is done in-house and that is a sophisticated piece of equipment. It is classified so you simply procure materials and we do fabricate that in-house.

Mr. **Lee**. At Lawrence?

Dr. **Davis**. At Lawrence, at Martin Marietta and any number of places could do that and we buy a lot of those things just by going out in the marketplace and buying the raw materials, but there are many shapes to the parts that we want to keep classified.

The collectors themselves are not very expensive. Most of the equipment is big tanks, pumps, that sort of thing. That is where all the money is. The collector itself is not a big part of the cost.

Mr. **Mead**. The lasers themselves, is that state of the art?

Dr. **Davis**. The copper vapor lasers are a state of the art in the sense of operating them, but in the sense of procuring the equipment, I would not say they are pushing the state of the art. Coors makes the tubes. We were using Thyratrons to make the switches.

We are going to solid state switching and moving away from the Thyratrons switches because we think it is a cost reduction.

Power supplying we have several listings of the companies that supply them in the briefing.

Mr. POTTER. Is there anything left out of the operating costs that we should know about?

Dr. DAVIS. I tell you what.

Let me put this chart up and give you our best answer to this question. Here is where I think the uncertainty is in this area here. Other operating costs is the in-plant operating. If you look at this, this is a third capital, a third operating and a third other—power and conversion costs. The reason that the decision in 1985 is going to be tricky is that we won't have the operating experience so we will be projecting very limited operating run times of our equipment. So that will be fairly uncertain an area of our program and where I think we will have the most difficult time defending ourselves in the competition.

The capital costs I think will be virtually bullet proof. Because of the procurements we are doing now I think we will be able to defend that very well. This area is going to be difficult for us because of the fact we have moved up 2 years. We just can't collect enough data.

Mr. LEE. Will you not have had maintenance history?

Dr. DAVIS. We will not have had enough maintenance experience to be able to get all that information.

The other 2 years would have made a difference there. I am with John. I think we ought to try to accelerate and save money if we can and try to be a little more insightful in the decision rather than just waiting until everybody could make a decision.

Mr. LEE. Are you going to win?

Dr. DAVIS. I think we should. I think they ought to bridge over from diffusion to the modern technology is my view. But, of course, it would be my view.

Mr. LEE. I guess I am trying to get a feel for the hardware components. There are no big surprises there? There is no really rolling of the dice, betting on the technological breakthroughs and that sort of thing?

Dr. DAVIS. I think the issue is in the operating times. You have got to get those up and the limited amount of time we have to work that problem out is going to require insightful judgment there on the part of the process evaluation board.

Dr. BOHN. The numbers in the history so far are operations on the order of a few hundred hours?

Dr. DAVIS. Let me make a point. To achieve economics, because of the high SWU rates in this process, you don't need very long lifetimes on the equipment. So the test times, like 1,000 hours on a laser, is 20 percent of its production goal. So, in our production plants, in other words, the lifetimes assumed for the lasers is 5,000 hours.

Dr. BOHN. Does that give you an upgrade part or would you replace it with an identical unit?

Dr. DAVIS. We think eventually they will simply run longer than that, but our economics, based on them having to run only 5,000 hours.

Mr. **Lee**. That is why you have only one out of six plants to be down?

Dr. **Davis**. No; that isn't the reason for that, but the availability on the lasers are extremely high. That is a long briefing to explain that, but it is because of the way the lasers are put together.

Mr. **Lee**. But you have to shut down every 5,000 hours under your assumption?

Dr. **Davis**. No; we maintain on line.

Dr. **Bohn**. You just take out one?

Dr. **Davis**. Yes; the lasers are modulars. They are boxes about a half meter in diameter and 3 meters long, and you take that out and insert another one and maintain on line. There are a number of lasers on this that are multiplexed together; if a laser fails, its effects are minor.

It is not like a Christmas tree. It would have a very small effect on the power level, because these are highly saturated systems so that a small change in power has very little change on performance. It is just the way it is designed.

Dr. **Whittenbury**. Jim, if you took the worst case on replacing components to remove the uncertainties in your operating costs, what would be the SWU costs?

Dr. **Davis**. Well, you know, I think the issue of this being uncertain and by a factor of two is going to be open. I think we will be able to defend it probably to about that level. If it is a factor of three, I would say I think we will be effective in convincing this evaluation board that we have got to manufacture it too.

Mr. **Whittenbury**. So the uncertainty would be a doubling of that component?

Dr. **Davis**. Of this component, yes. Now, the separater unit that is going to be running at Oak Ridge on the materials handling module, that I think is our most vulnerable area, and they are going to try to run 25 percent of the production cycle, which is a 100-hour run. If they get that, then I think we will be able to defend this within about a factor of two.

If we are fighting that problem come selection time——

Mr. **Lee**. And what is their schedule?

Dr. **Davis**. To do it by next March or February timeframe. They are starting to operate now. We test things for short runs, and then you see if there is any problems and test a little longer and so forth.

Dr. **Bohn**. What is this 1 million SWU facility you said you are building now?

Dr. **Davis**. That is a production prototype. That would have been finished and in operation in 1987 under the old plan.

Dr. **Bohn**. Is that useful for production?

Dr. **Davis**. We are planning to use it for training and operations procedures and development of all that type of stuff for the production plant in Oak Ridge, but it will obviously produce some material that will be usable material. We will keep that. But it is not being scheduled to produce.

Mr. **Mead**. That is being produced where?

Dr. **Davis**. That is at Livermore. There is a joint team doing that between Martin Marietta, Livermore, Stone & Webster, Bechtel and our equipment suppliers.

Mr. **Potter**. You have $7.25 for capital costs, just to give us an idea of how things can slip. That works out at 10 million SWU's to about 4.8 percent per year capital costs on the $1.5 billion.

Dr. **Davis**. The policy is straight line 25 years.

Mr. **Potter**. So what is capital cost? That is the amortization?

Dr. **Davis**. Yes. By policy these things are depreciated over 25 years.

Mr. **Potter**. So the capital cost represents amortization?

Dr. **Davis**. Yes. It is return of capital and return on capital.

Dr. **Bohn**. But Fred is saying the interest rate you have in there must be close to zero.

Dr. **Davis**. I think the numbers, I don't know. They are DOE numbers. Are they 10 percent?

Mr. **Lee**. Our problem is you have $150 per SWU invested.

Dr. **Davis**. I understand your point. In the private sector analysis, we do this with accelerated depreciation over 10 years and this number jumps up.

Mr. **Potter**. But how much have you got invested?

Dr. **Davis**. In this case, $1.5 billion.

Mr. **Potter**. So that is $150 million a year in dollars, is that right? And then you produce 10 million SWU's?

Dr. **Davis**. Ten to thirteen.

Dr. **Bohn**. That is $15 per SWU.

Mr. **Potter**. Yes; that is a factor of two right there.

Dr. **Bohn**. Not $7.25.

Dr. **Davis**. My understanding of the policy on that number is 25 years.

Mr. **Potter**. Maybe this is an average over the 25 years. Is it?

Dr. **Davis**. Yes, I think it is. That is the way it is done.

Dr. **Bohn**. It still doesn't work.

Mr. **Potter**. They did $15 and they divided by two.

Mr. **Lee**. Its $7 plus $9.

Dr. **Davis**. I understand what you are saying. If you took $150 and divided by 10, it would be $15. I understand that. That is not the way it is done.

Mr. **Lee**. Well, we have apples and oranges, because with gaseous diffusion, we have a different depreciation and interest schedule built into the price that is being charged under new contracts; for example, $1.25 is not consistent with the basis calculated and calculating the price under the new contract. We recognize it is not, so let's go on.

Mr. **Potter**. One last question.

What about useful life of your facility? Can you give us an idea how long it lasts and to get it to last this long, how much you have to spend in important improvements and maintenance?

Dr. **Davis**. Well, of course, the building, the whole structure, lasts forever, but the special equipment cost, as a portion of this, I believe is about 40 percent.

Mr. **Potter**. Of the $1.5 billion?

Dr. **Davis**. Of this capital here. Now of that, probably 10 percent or so would be replaced. I don't have those numbers off the top of my head.

Mr. **Potter**. Every year?

Dr. **Davis**. Yes, every year.

Mr. **Potter**. And how long would it last at that rate, 20 years?

Dr. **Davis**. Yes, I don't see any reason why not.

Mr. **Mead**. Was that in those other operating costs?

Dr. **Davis**. Yes.

Mr. **Potter**. Twenty-five years I guess.

Dr. **Davis**. Pete Lotts got this information from the data sheet and constructed this sheet. Could you shed any light on that number, because that was taken out of the data sheets.

Mr. **Lotts**. On the capital?

Dr. **Davis**. Yes. I think the point is valid. I thought the number was four percent, 25 years straight line, and they were doing that type of analysis.

Mr. **Lotts**. I can't, because I don't have the data sheets with me, but I didn't do the original analysis. I took it off the tabulation.

Mr. **Lee**. That is right, at four point something percent of $150.

Dr. **Davis**. I think that is the way the calculation was done.

Mr. **Lee**. That is depreciation. We don't have interest yet.

Dr. **Davis**. Yes.

In light of the time, unless you want to cover this, I would skip over it and summarize for you the position that we see ourselves in right now, and I think the projection that we are making. We were selected by DOE, among several advanced processes in 1982. It is the one having the best potential to do less than $40 a SWU. I still think that is valid. Our demonstration results have continued to validate that selection that was made a few years ago.

The demo facility that we are constructing and operations that are more than 2 years ahead of the schedule originally projected at that time, we think, that partial pilot operations in 1985, if we are talking about this selection, will support the projection of less than $40.

Now, if we go to the full production prototype operations in that facility, we think we will verify the $40. And we believe if that is done and a decision is made to go into production with AVLIS, then we will come down to $40.

Thank you.

Mr. **Lee**. Jim, we thank you very much.

Are there any questions?

[No response.]

Mr. **Longenecker**. Mr. Chairman, it appears to me that that brings us to the point of our telling you what we do with all this data once we get it. I would like to preface the remarks on the process evaluation board by emphasizing that the type of investment analysis that you discuss are being done under the next activity that is going to be presented.

The thing that you asked for is precisely the analysis that PEB will conduct under the selection process and our decision will be based principally on those results. Now neither data set you have seen today has been validated. Roger, you asked the question, is the program still being driven somewhat by technical changes? And it is in a transition.

We had a heavily technology driven program where we did not do in the past check or investment analysis. We are now taking the strengths of those programs, and we are the leader in the world in technology development and validating constant check data and then doing an investment analysis subsequently which we will have completed and will use in the decision next spring.

What we are looking at, because I know, in looking at the briefing charts today, it is not covered there. I would like to preface the process description by saying the economic criteria have largely been established that we will use for the investment analysis. We recently completed that activity, and we will look at two things: total enterprise perspective on uranium enrichment, SWU prices, discounted cash flows, return of investment and total enterprise costs comparing different mixes of GDP's, AGC, and AVLIS.

Second, we will take from a separate cost center perspective, we will look at investment costs, internal rate of return and SWU prices and cash flows, and that is the investment analysis that is yet to be done. You share our frustration in not having that set of data, but that is a process that we have underway, and you come during midstream in that process.

What Kermit Laughon will be describing for you is the makeup and the schedule and the overall process that we will go through between now and May 1985.

Dr. BOHN. The other point I think I would like to make, and I have seen some awareness of it in the presentations, is that the economic criteria and the business approach feedback to the design goals.

Mr. LONGENECKER. Absolutely. You are right.

Mr. LAUGHON. OK, well, Mr. Chairman, members of the panel. My name is Kermit Laughon. I have been involved in the enrichment business for approximately 2 months now as a member of the process evaluation board, and I can assure you that I am still learning a great deal about the whole enterprise.

Peter Johnson, who is the chairman of the board, has asked me to express his regrets to you that he could not be here.

Mr. LEE. Is that Peter from Bonneville?

Mr. LAUGHON. Yes; and I will go through the board membership for you and let you see who we are, and then discuss what we are doing, our schedule and how we are going to get to a report in the months ahead.

Process Evaluation Status

Kermit O. Laughon

Executive Secretary
of the
Process Evaluation Board

Advanced Technology Process Selection

- **Advanced Technology Will Be Basis Of U.S. Enrichment Industry In Future**
- **Two Competing Technologies: Advanced Gas Centrifuge & Atomic Vapor Laser Isotope Separation**
- **Selection In May 1985**
- **Selection Decision Based On Technical And Economic Merit — Best Assurance Of Lowest Cost SWUs For Long Term**

Very quickly, as a basis for my remarks, I think you have heard we are looking to advance technologies for the future. We are looking at two competing technologies you have heard about this morning. We are heading for another decision next May. Fundamental to all this is the desire that this decision be based on technical and economic merit.

Membership of Process Evaluation Board (PEB)

Member	Affiliation	Principal Review Responsibilities
● Peter T. Johnson Chairman	Administrator, Bonneville Power Administration	Business Management & Market Analysis
● James E. Leiss Vice Chairman	Associate Director for High Energy & Nuclear Physics; Office of Energy Research	Science & Technology Management
● Kermit O. Laughon Exec. Secretary	Director, Office of Spent Fuel Management & Reprocessing Systems; Office of Nuclear Energy	Nuclear Engineering & Program Management
● C.N. Mitchell	Director, Office of Project & Facilities Management; Office of Management & Administration	Plant Design & Cost
● Norton Haberman	Director, Office of Advanced Technology; Office of Uranium Enrichment	Science & Technology
● Sherry E. Peske	Director, Office of Marketing & Business Operations; Office of Uranium Enrichment	Business, Economic & Market Analysis
● Joseph W. Parks	Assistant Director for Planning; Oak Ridge Operations Office	Program Planning, Business & Economic Analysis

The board, as it has been constituted by the Secretary, includes the individuals shown on this chart.

Mr. Johnson, as you note, Bill is the Administrator of the Bonneville Power Administration. Prior to that, he had a business background.

We have Dr. Jim Leiss as our vice chairman. Dr. Leiss is on travel this week; otherwise he might be here in my stead.

You have me, who until I became involved in this, was fundamentally responsible for reprocessing activities within the department.

You have Mr. Dean Mitchell who has experience previously in the naval reactors and currently has a position overseeing plant design and cost for the department, and then we have three members of John Longenecker's staff. Dr. Norton Haberman, who is responsible for managing the advance technology programs. Sherry Peske, who you heard from yesterday, and Joseph Parks from Oak Ridge, whom you have also heard from.

We were chosen, we were told, because of a specific mixture of backgrounds and experience, and, as you see, on the right we do, in fact, come from several different sectors. Collectively, we hope to have the horsepower to do this job properly.

Mr. POTTER. Kermit, there are seven people on the process evaluation board, and all of them worked for the Department of Energy.

Mr. LAUGHON. That is correct.

Mr. POTTER. Was there any thought given to bringing in any seven outsiders?

Mr. LAUGHON. There was an effort last year, John perhaps could speak to this also, in which a group of people were selected, including Manson Benedict and a number of other people, to look at the whole enterprise. But this activity, because it is a department decision and because it is not being undertaken, if you will, as a rulemaking or as a public type decision, we chose to use DOE personnel to prepare the report for the Secretary.

Mr. LEE. It wouldn't be upsetting to you too much, would it, Kermit, if this panel had certain recommendations along that line? For example, in the transition, we want to be customer oriented now.

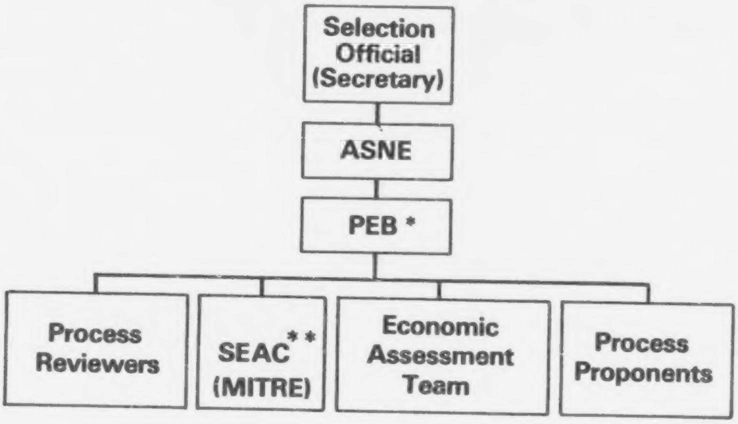
Mr. LONGENECKER. Bill, another way of stating the basis for selecting that panel was this is a group to manage process selection. They will not, as an independent body, do the analysis or present it or act as a separate entity. They will be drawing on information from our customers. We had through Edison Electric a group identified from U.S. utilities that will be involved providing input. They also have Mitre Corp. under contract and will be drawing from various technical and economic consultants from the private sector to do analysis and provide data.

So this is the group that manages that, to answer your question. This is not the totality of people involved for overviewing or inputting to the process.

Mr. POTTER. Who makes the decision?

Mr. LONGENECKER. The Secretary.

Process Selection Organization



* PEB - Process Evaluation Board

** SEAC - Systems Engineering & Analysis Contractor

Mr. LAUGHTON. Fundamentally, we are organized to function as shown here. The process evaluation board does report to the Assistant Secretary for Nuclear Energy and the Secretary who is a selection official. Under us are fundamentally four different groups. There are process reviewers and proponents who are the contractors actively promoting the technologies and who have some interest in critiquing the other person's technology.

We have a contractor, Mitre, to do selected analysis and study efforts as we need them and as we call for them for the board, and then we have an economic assessment team, which is really Martin Marietta in Oak Ridge, who will perform the specific economic studies that we request. I will show you a little more of that.

Participants & Their Roles in the Selection Process

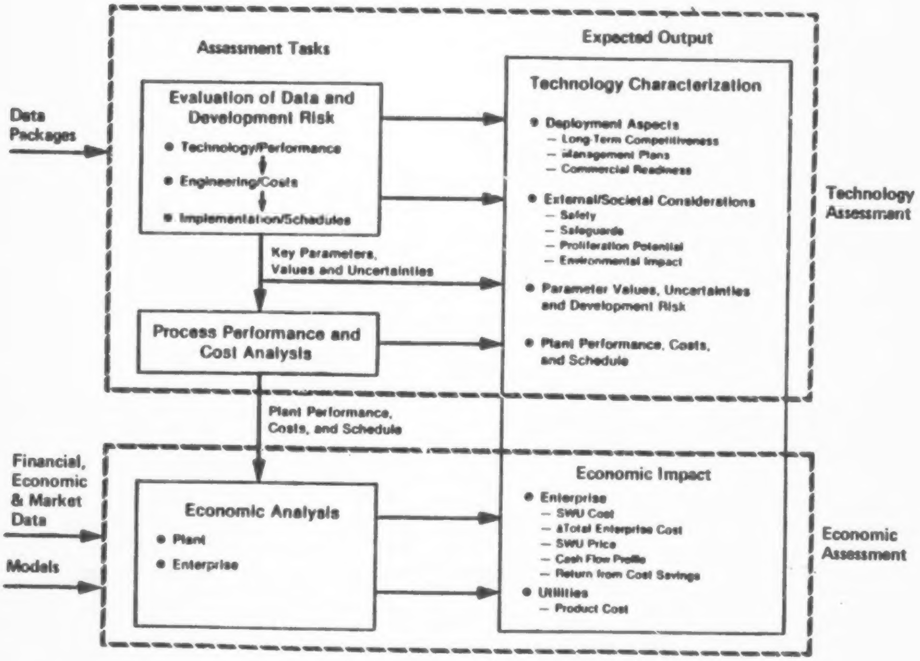
Participants	Association	Role
● AGC/AVLIS Review Teams	AVLIS/AGC Contractors	Reviews & Critiques the Competing Programs
● Systems Engineering & Analysis Contractor	MITRE Corp.	— Coordinates Review — Analyze Technical & Cost Uncertainties — Analyze Business & Market Factors
● Economic Assessment Team	Martin Marietta Energy Systems, Inc.	Develops & Maintains Computer Models of Process Physics, Plant Design & Process Cost for AGC & AVLIS
● AGC/AVLIS Proponent Teams	AGC/AVLIS Process Developers	Provides AGC/AVLIS Program Plans, Baseline Design & Supporting Documentation
● Process Evaluation Board (PEB)	DOE	Performs Final Analyses of All Data. Documents Findings & Recommendations

The review teams, again, are comprised of the contractors who are developing the technology and who, therefore, have an interest in critiquing the other person's technology. There is an adversarial peer review process.

Again, here is Mitre to do selective tests as we request. The economic assessment team, I am sure, can turn out more economic studies than we will all have time to look at, so it is important that we define carefully those which we are interested in.

Again, here are the proponent teams, which Mr. Davis and Mr. Sommerfeld lead and the process evaluation board. We have responsibility for the final analysis of all data requesting information be generated. We, and we alone, develop the report for the Secretary.

Overall Framework for AGC/AVLIS Assessment


Assessment Tasks
Expected Output
Data Packages
Evaluation of Data and Development Risk
• Technology/Performance
• Engineering/Costs
• Implementation/Schedules
Key Parameters, Values and Uncertainties
Process Performance and Cost Analysis
Technology Characterization
• Deployment Aspects
– Long-Term Competitiveness
– Management Plans
– Commercial Readiness
• External/Societal Considerations
– Safety
– Safeguards
– Proliferation Potential
– Environmental Impact
• Parameter Values, Uncertainties and Development Risk
• Plant Performance, Costs, and Schedule
Technology Assessment
Plant Performance, Costs, and Schedule
Financial, Economic & Market Data
Models
Economic Analysis
• Plant
• Enterprise
Economic Impact
• Enterprise
– SWU Cost
– ΔTotal Enterprise Cost
– SWU Price
– Cash Flow Profile
– Return from Cost Savings
• Utilities
– Product Cost
Economic Assessment

This is a busy chart, and I apologize for that. However, it does serve to illustrate the approach we are taking. As John indicated earlier, it really breaks into three fundamental pieces. First and foremost, and I say this as an engineer now, we must scrutinize the technologies, the status of the technologies. What has been done, what can be done, what are the risks, what are the uncertainties and what remains to be demonstrated. We do that through a process characterizing technologies with the ultimate objective of coming down to singular cost data that we go with each of the processes and the plants to be constructed associated with them.

Having done that, then, one can move into and do as many different types of economic analyses as you desire.

For example, as John indicated, we will be looking for the enterprise, its SWU costs, the change in the total enterprise costs for various scenarios of introducing the two technologies, SWU price, various cash flow profiles, return from investments and then on behalf of utilities what is our product cost?

Mr. MEAD. You need to do that for a variety of scenarios?

Mr. LAUGHON. Many scenarios. The difficulty on the scenarios is going to be to define those which are really meaningful and get the correct data to begin with. It is easy to run an economic scenario, but you have got to have good data.

Information Exchange

Data Packages:

May 1984	– Reports on Background & Status of Technology
Aug 1984	– Plant System Requirement – Analytical Model – Status of Technology
Nov 1984	– Conceptual Plant Design & Cost – Program Plans, Including Management & Technology Transfer Plans

This board was established on June 29 of this year, so we have actually been functioning about 6 weeks. A key part of the process is to develop data packages which the contractors are developing on the schedule shown here. These data packages then become a fundamental basis for additional work and for peer reviews.

Process Selection Schedule

Interim Selection Criteria	Apr 17, 1984
Establish Methodology For Comparison	Jul 31, 1984
1st Major Review Meeting	Oct 1984
2nd Major Review Meeting	Nov 1984
3rd Major Review Meeting	Jan 1985
Experimental Data Cutoff	Mar 1985
4th Major Review Meeting	Apr 1985
Complete Evaluation & Prepare PEB Report	May 1985

For the process evaluation board, I would note, in summary form, here is how I view the major milestones. Interim selection criteria were issued by the Department in April, prior to actual designation for the board. Following establishment of the board, the criteria were finalized in the broadest framework with full acknowledgement that we have got some additional refinement to do, specifically in specifying how the economics are to be done and which scenarios, what the ground rules are.

We are now looking toward a series of major review meetings which typically will last 3 or 4 days and which would be in great detail, reviews of the technology, both by the proponents and by the reviewers and reports by the economic assessment team, all under control of the process evaluation board.

At the same time, during the year, I think you have heard there is some critical experimental work going on for both the centrifuge and AVLIS programs and certainly that has to be factored in, and we are looking now for March 1985, a cutoff for this report, to be prepared for the Secretary. The scheduled date is May 1985.

Fundamentally, that is all the visuals I had to show you. I would be pleased to answer any questions.

Mr. LEE. Are there any questions for Kermit?

[No response.]

Mr. LEE. Thank you, Kermit, very much.

Mr. LONGENECKER. Your previous unanswered question, the answer is yes. Further, you asked would we benefit from the board's recommendations on how we conduct the process, who was involved, and the answer is yes. We have been about this only 6 weeks. It is a crucial decision to the future of the enterprise, and we would welcome your suggestions, both on the process.

Mr. LEE. We understand. We happen to be here at this point in time, and it is only very recently under budget pressures that you accelerated your decision date to May 1985. I realize you are moving fast.

Dr. DAVIS. I talked to people about the numbers on capital. What is being used is the production weighted. It is in the forward averaging the DOE uses. That is how those numbers were generated. I can reconstruct those and send them in if you would like.

Mr. POTTER. I would like that.

Dr. DAVIS. Part of the capital is covered in the conversion. We can generate those numbers and get them to you.

Mr. LEE. Like when?

Dr. DAVIS. How much time can I have?

Mr. LEE. How about the middle of lunch hour?

Dr. DAVIS. I will work on them. I will work them out and give you our best response as we can in the next hour.

Mr. LEE. We will excuse you and your associates, if you like, to let you go to work. Find them a place, please, staff.

Mr. MEAD. It would be nice to have that for the other process, too.

Mr. POTTER. Larry makes a point. If the other team competing would like to produce a comparable number, numbers, or could produce any kind of comparable numbers to the numbers here, that talked about total investment and how much it costs to operate it, then shows you what the operating costs were, they didn't add up, but they came close enough, then they are off by, you know, give or take, approximately two times. If you all wanted to do that in the next hour that would be fine, too.

Mr. LEE. The panel, I think, has received information on the new contract and pricing structure out of the diffusion plants. It also received information on worldwide situation. It caught our attention. We are the highest cost producer in the world. So we have a very keen interest in where our nation is headed.

We hit you at the wrong time. Nevertheless, we didn't ask to be appointed.

Mr. **POTTER**. And we are not trying to get, John, to the numbers. I mean, if Jim says he is off by a factor of two, I think you can accept that.

Mr. **LEE**. That is good information.

Mr. **POTTER**. But the idea is to convince us that we are not trying to be—to maintain our position as the high cost producer under all circumstances. I think that is the kind of confidence that I would like to come away with.

Mr. **LONGENECKER**. That is not our objective. In the information we have put together today and at the end of the day, if there is additional information, and we have a wealth of it, believe me, we would be glad to provide it.

Mr. **LEE**. We want to call on you for two things. One is a discussion of privatization and the other is any additional information not discussed or any—we don't really have time for a summary of 2 days. I think we have got a little time.

Mr. **LONGENECKER**. What I would like to do is go through briefly a history of what we are doing. There have been a number of matters involving private sectors. Primarily, they have involved full privatization. The common thread that runs through them, if you look at the reason they have failed they are because of the large financing requirements that were imposed on any potential participants, long pay back periods of time.

Technology has been classified and restricted. And very importantly, the uncertainty regarding future Government actions. It has not been consistent policy of the administration in the past 20 years on privatization.

Mr. **MEAD**. Do you expect technology to continue to be classified for the indefinite future?

Mr. **LONGENECKER**. Yes, it will continue to be classified. It can be made available through a rigorous process of industrial access, but because of the proliferation aspects it will continue to be classified. My first chart I just wanted to emphasize why the attempts in the past have failed. I said they are primarily as the private sector looks at it, it is a lot of money.

It is a long time to get pay back, classified technology. Finally, the uncertainty regarding future Government actions; that runs the realm of licensing to nonproliferation policy.

Mr. **LEE**. There are some other reasons for failure, too, besides those.

Mr. **LONGENECKER**. Yes, sir. The new obstacles since the last major initiative, the Nuclear Fuel Assurance Act of 1975 includes declining nuclear power growth and emergence of fears of foreign competition. However, further since 1975, both AVLIS and AGC, as you see, offer, we believe, unprecedented opportunities for private participation based on the promise of manageable capital costs and reasonable pay back periods.

Those data are not fully presented to you, but in our analysis of the two and your serve view, we think they both have that attractiveness. They are both economically productive and have modular production capability, ability to respond quickly to changes in market; third, highly competitive unit costs of production both with gaseous diffusion and our foreign competitors.

So that is where we have been and where we stand today. What is DOE's role in that and what do we perceive our role to be? It is simply to establish institutional policy framework amenable to private involvement in uranium enrichment.

It is this administration's objective to privatize uranium enrichment within the context of the practical aspects of the uranium enrichment business as it exists today. So we would first and foremost like in all the activities we undertake in the future years to establish that institutional policy framework. The steps we have taken to do are, first, the process evaluation board which is doing the type of investment analysis or will be receiving it that we have not heretofore had.

We have a private sector financial working group that is evaluating all the options for getting some private sector involvement, from full privatization to some sharing of the near term costs of R&D and building the next increment of capacity.

That is a within DOE group; that's correct. Finally, we are looking at the institutional policy framework for the deploying advanced enrichment technology. What does DOE need to do to assure that private sector can deploy one of those options from an institutional policy point of view.

These proposed actions will be taken in fiscal year 1985. This is the fiscal year starting at the end of next month. The process evaluation board is going to assess the technical and economic risks associated with each technology. Kermit just described that process to you. The financial working group then will develop additional data packages interacting with private sector investors, giving it to them in a format they are accustomed to seeing.

Those packages are shown here. They include the enterprise prospectus, if you will. Give them our market forecast, business strategy, legal opinion on the various aspects of private involvement. Then our assessment of some of the—how some of the financial options would weigh within our Government framework.

What we are trying to do with that is to provide only a uniform package for the private sector to use and evaluate to determine their interest in this. The private finance working group will turn their results over to the process evaluation board for their consideration in the process selection and depending on the outgrowth of that they will use it in its appropriate manner.

But we believe that is an important piece of information to us in the future and to the private sector in determining when we decide to go forward with any new capacity or invest in R&D. We ought to know what the private sector investor thinks, how he would view that investment. Second, we ought to know from a cash flow point of view the feasibility of attracting any investment in the new technologies, because that will determine to some degree the pace and timing for introducing new capacity.

You saw from the GCEP discussion yesterday when you looked at how our budget is constructed the schedule for building GCEP or AVLIS or any plant capacity is constrained by revenues today. It is constrained by the amount of money which you can generate in any given fiscal year. We do not have a line of credit we can draw on to optimize cash flow with the optimum construction of new capacity or R&D.

That is a prime determinant in deciding any decision to employ technology is availability of that capital because either in part or whole because that will in some measure determine how quickly and efficiently we can bring new capacity on line. So this is a very important activity for us. Again, it is just beginning. We are in the very formative stages of this.

And we have been in touch with some companies in the investment community already. We are drawing on the experience of some of the contractors that you see here today, Garrett and Goodyear, who made proposals for privatization of the industry previously. And we believe that this is an extremely important activity.

We would again appreciate any comments that you have on how this might proceed over the next year.

Mr. LEE. Thank you, John. Chuck Rowan, do you have any comments you would like to share with us about your company's privatization?

Mr. ROWAN. Thank you, Mr. Chairman. I will, just for a few minutes. Just to quickly help put the story in perspective, it includes kind of a backward look at a few years in time at one of the principal activities we undertook. To understand that bit of a story I need to spend a moment explaining the company organization because it bears on the statements.

We have had activity in enrichment systems since 1961. Our activities have embraced all three technologies, diffusion, centrifuge, and laser. Garrett, itself, is a part of the Signal companies. The Kellogg arm of Signal built the first diffusion plant in the country, and operated it in Oak Ridge. The one that subsequently was operated by Union Carbide, Martin Marietta, today.

Our equipment development activities and manufacturing activities of nuclear related are primarily centered in Airesearch in Los Angeles, the division I am associated with. So we have a history that goes back sometime in enrichment. Primarily in development and manufacturing mode. But we are also quite active in trying to develop a private enrichment enterprise, with not a success result at the time.

I would like to go back to that principal activity which was in the midseventies. Garrett had a company at that time with the name of Texas Regional Enrichment Corp., TRENCOR. It was formed by Garrett to develop, construct, and operate a private enrichment plant. Other industrial firms in the country were engaged in similar activities at approximately the same period of time.

Just for the record, some of those groups were a company called Centar—that was a joint venture of Arco and ENI. Exxon and General Electric formed a joint venture called Cengex, both of which—both Cengex and Centar dealt with centrifuge technology at the time. Uranium Enrichment Associates was a major effort in gaseous diffusion before the decision was made by the Carter administration to build the GCEP plant at Portsmouth.

Plans were afoot to build a new enrichment plant with the diffusion process in Alabama. The principals in that organization were Bechtel, Westinghouse, Goodyear, Union Carbide, and Williams

Companies. In the world of laser, of course, there was an earlier effort, some significant by Exxon, Jersey Nuclear Avco and that process is in part what Livermoore is using today.

Their own work and JNAIS were combined. So there has been quite a bit of activity trying to happen in the last decade with very checkered results to say the least; not really success despite the valiant eforts on it. In the case of Garrett, TRENCOR business structure which perhaps offers some model for consideration today on it. I am very proud of our efforts on that at the time.

The Garrett Corp. surveyed over 115 firms and investment partners, potential partners in the country on for TRENCOR firms of national repute. Out of that whole group it distilled down to about six, after a period of nearly 3 years of effort to try to formulate and establish the framework for a private enterprise.

Finally, we went ahead on the initial part of it ourselves on it, because even with those six, we were unable to get final firm commitment. On our own initiative, however, we did concentrate very heavily at that time on two outstanding utilities in Texas at that particular juncture of the game. They were triple A bond ratings. They were just first class utilities. Still are today.

But they have suffered the slings and arrows of fate, as many utilities have in the intervening years. But we had negotiated firm contracts with them. That is, the model of the contract, detail of the terms and conditions on it. We had letters of intent and agreements signed by the top utility officials on it agreeing to buy the output of the plant.

The plant was designed to be built in a modular fashion that would have, have closely tracked the then-projected requirements of the two Texas utilities involved on it. The initial module was about 350 metric tons. The others were added on in increments that added up to a total of about 3,100 metric tons.

Dr. Bohn. In SWU's, what would that be?

Mr. Rowan. 3,000,000. Also at that time we had substantial guidance and assistance from Wall Street investment firms, principally Kuhn Loeb at the time. They guided us substantially on what would be the doable do financially over the long haul on this and what would be required in order to attract the additional investments from institutional investors primarily and eventually, the public.

That was the goal for it.

Mr. Mead. What was the year?

Mr. Rowan. 1975–76, right in that period. So I am going on only to illustrate to you the very, very substantial effort on it.

It failed, because it relied principally on some Government guarantees that were necessary to launch the venture. And in order to have those guarantees and assistances for the periods of time that our financiers at that time advised would be necessary, it was also necessary to have congressional approval.

That led to the request by us and others for congressional sponsorship of the Nuclear Fuel Assurance Act, which did not pass. Moving ahead, though, in that scenario today and it is as true today as it was then, the character of it is still there. Perhaps the emphasis on each point has changed somewhat with the passage of time, but still and all, today from a business standpoint, the issues really boil down to four categories of risks.

This chart is an identification of the various risks. There is an investment group of risks. There is a marketing challenge or marketing risk kind of category that has to be considered, technology issues and just plain old political realities in many different areas that must be considered.

Even though they are political, they do translate directly into financial considerations, financing considerations of all kinds. So without trying to develop these to any great depth at all on here at the moment, we just won't have time on it, I think, the thing I would like to say to you from our standpoint and our company's, these issues still pertain.

We do think they are solvable. They can be, with a collaborative effort between the Congress and the Department of Energy the administration, and with industry in it. And we think it is possible to do in a progression over a period of time. We don't think it is black and white, one way Government or one way private. Speaking solely for Garrett, I have reservations personally in the long pull that private industry and United States should have become a seller of SWU's to anyone other than the U.S. Government.

It primarily has to do with considerations in this quadrant more than anything else, plus the fact that there are very, very important national defense and international relationship issues to be considered because it is nuclear fuel.

Mr. POTTER. Besides a Government guarantee, you could acquire financing by some form of take or pay arrangement.

Mr. ROWAN. Indeed, Mr. Potter. That was the basis of the arrangement at the time. That is what made it a nearly go situation. We had that commitment for long-term buyout on a take-or-pay basis for about 80 percent capacity of the plant.

Yes, indeed. While a lot of very heady issues are identified here, you kind of slice through them all on the very point, well taken. The heart of the matter really is for industry to risk, whether it is to risk money on the development, further development of a process, whether it is laser or centrifuge or chemical exchange process, process, or some greatly improved diffusion, process whatever, for industry to do that, you know, it is like any other business.

There has to be a quid pro quo. You have got to have the guarantee, the reasonable assurance of an outlet, a market, a price to sell your wares and services on it. So when those ingredients can be brought together in any kind of business arrangement, you have the makings of a deal, a way to get there on it.

Many times that fundamental point is overlooked by a lot of people.

Mr. POTTER. This is an ambitious question. But today, if you and I were to make a proposal to the Government to provide *x* million of SWU's, and I told you all we needed was a take or pay arrangement from the Department of Energy, what kind of a price could we give the Government?

Mr. ROWAN. SWU price?

Mr. POTTER. Yes.

Mr. ROWAN. Oh, God! That is a heady question. I have very high confidence in our technology. It is obvious you are suffering a lot of frustration by not getting as specific and direct an answer as you were really begging to have. From the community standpoint out here it is a little premature. Almost every question was framed in terms of dollars per SWU because that is only natural.

To get to those answers authentically one must have available for the instant answer the depth and breadth of information involved in the enterprise models, which are extremely complex. The complexity of them is generally caused not so much by the technology issues involved, although that is there, but rather the assumptions made about the unit price, longevity, of the market——

Mr. POTTER. Develop those models in the ordinary course of business.

Mr. ROWAN. I think our board, were they ever faced with that exciting possibility, that they would probably vote yes for that under the right circumstance. We don't have time to list caveats. The caveats have to do with these things in our view must be answered by the combination of administration, Congress, and interested industry. Interested industry includes people like ourselves that are in the enrichment equipment business or perhaps have aspirations to be in the SWU business, but also and most importantly the utilities that are buying it.

Mr. POTTER. How would this sound as an approach? People come into the process evaluation board, and they make a presentation. And they make certain representations about the deliverability of SWU's. Maybe the board could approach it two ways: One, it could not say which way it is going to go; that is, it would be 100 percent Government funding, or we will do some kind of private approach before you make the presentation.

Or, we could say that if your off by a certain amount, the first certain amount that you are off, you eat; in the same way that utilities are being regulated today. How do you think that would be as an approach of the evaluation board? Do you think that would be a good approach for them to take?

Mr. ROWAN. That, too, is an exciting possibility and there is a lot of potential connected with that. I have two kinds of immediate reactions. One is, I would love to do that, A. B, wisdom tells me that there is a key problem connected with doing it. But maybe it could be approached. The key problem, of course, is the fact that the closer one moves from talking about it in generalities to specifics and hard arrangements, the more there becomes involved proprietary business approaches and considerations and they have greatly, the opportunities.

They are unique to each offering business group or venture group. And so at issue here would be how often in public could one go moving toward that direction where we might all like to be eventually, but without the protective cocoon that would always be there, normally be there in a true—in the case of the Government, are they doing it, RFP environment.

There is a legal thing surrounding that, Mr. Potter. Protection of the offers of——

Mr. POTTER. How does this sound to you, though? The Secretary of Energy says I will go with *x* company and everything is the same except that. And the proposal for *x* company is that they deliver these things at $75 an SWU. You know, it is specified every year.

And the first $5 that they are off, they eat. What is wrong with that? That is sort of a little bit of private enterprise, but it is still the cacoon approach.

Mr. ROWAN. It would be in there. The elements of what you are talking about in principle were there even in our proposed contract arrangement with the Texas utilities. The elements, principles——

Mr. POTTER. Yes.

Mr. ROWAN. I am sure they were there. That leads me to and I know you need to move on here really to perhaps the last thing I want to say to you here. It is very important. Speaking to DOE, really, we would say the same thing to our distinguished panel here. First and foremost, really clarify policy.

Where is the Government going? Is it private investment, or is it privatization, two distinctly different things? Is the Government headed in the direction of keeping generally the institution of enrichment in place as it is today, but with all the refinements introduced into it that you have heard about from all the different proponents today and yesterday?

Or are there and therefore it winds up, say, with the thing going off budget, and you head in that direction trying to find private financing for the entire enterprise operated as a Government entity. Or do you completely go privatization route? If you go privatization, obviously there are many different levels.

With all this effort in the case of our company over the years, quite frankly most of those efforts have failed. It is obvious, at privatization. They have never succeeded. There has been just a tremendous stream of them in our case on the thing from going back to the early 1970's. Anywhere there was a target of opportunity, consistent with its corporate charter and interest, and so forth, whether it was activities in Austraila, whether it was GCEP to be sure, whether it was unsure whether to be added on, high speed rotating machine people.

We tried and did succeed in winning on a competitive basis development contract. Union Carbide, of course, never bought, so on down the line. James Davis, I proposed to work for, assist him on that. We didn't win that competition at the time. I like to think I put in a good proposal for the work that was required.

What I am trying to say to you is, we haven't failed to try to identify, promote and act on intelligently and responsibly any and every opportunity that came up. Almost all of them had failed for a variety of reasons. And so, if there is going to be privatization or private investment, those important distinctions and that is the first thing that needs to be done.

I think secondly you have to recognize not subsidy, but you cannot expect that an industry has been for 40 years under Government domain can move instantly without some transition process in which Government backing, for the want of better words, to aid and assist in that there.

The Government is owner of the technologies involved. There has to be a plan for step-wise progressive transfer to industry. R&D programs obviously would have to be restructured in all technologies to match the plan. And you have to consider the investment community critical requirements.

If it is not bankable, whatever it is you have in your deal, you are not going to get financing. You would be the first to tell us that. Certainly DOE is trying to deal realistically with the diffusion plant turn down and the TVA contract problems. Bottom line, adopted plan has to do two things from our point of view. It has to protect existing and any future private capital investments, no matter what technology they are invested in.

And it has to carry with it the idea of the notion of implemented action, that there will be a need to restructure both R&D and new equipment production in order to expedite plant modernization. From my standpoint we are just kind of caught in a morass.

DOE is working their fanny off to overcome that problem. I do have to say publically here that I think there is more management action, more management direction, more management impetus and action in recognizing all of these problems and doing things on them in DOE than I have ever seen in the time I have been in the program which is about 15 years.

Others have been here longer than that. They have really consciously and conscientiously tried to do that.

Mr. POTTER. In the last year?

Mr. ROWAN. Yes, indeed. Yes. Anyway——

Mr. LEE. I think our panel recognizes that, too.

Mr. ROWAN. Good, Mr. Lee. I am glad that they do. They do deserve that recognition.

Mr. LEE. Yes. Thank you very much.

Dick Grant, do you want to add anything to our knoweldge about privatization?

Mr. GRANT. I really didn't come prepared to talk about it, but I have had an opinion on it for a long time, stated it publicly once in a while. I will real quickly tell you what it is.

A lot of the same things Chuck said—first thing is that there was a period we went through not too long ago when everybody was saying there is no way to privatize uranium enrichment. Of course, that is crazy. Obviously, there is some way to do it.

You may not like the terms, but there is clearly some way to do it. Then when you start examining what the terms are you come up with things like the Government has to quit doing R&D because the private sector is unlikely to go into competition with the Government's R&D base, and obsolecence sort of thing for one thing.

Of course, the Government also has to stop using uranium enrichment as an instrument of policy because part of your marketplace out there is very susceptible to that. They are unlikely to be willing to risk that. As a practical matter the time flow on privatization is probably a lot longer than any of us even sitting here would imagine and we have all probably got a fairly long horizon on it.

Gestation period would be long. What is happening in the meantime is that the position DOE is finding itself in is that they have to be more in the position of selling a business rather than having someone start one with the way it is now. And up until John got started in this business, DOE did not have a business to sell.

He is trying desperately to put a business in place. The analogy I have used a few times is it would be like Boeing or Garrett or somebody going out and buying United States Steel and walking in the morning after you have bought it and everyone was gone, you see. How in the world do I make steel and who do I sell it to and things like that.

But there are steps being taken to put a business in place that may fit those kinds of molds. You were mentioning a possibility of risk sharing by pricing dollars, plus and minus. Actually of course that is really just a fixed price incentive contract where the floor is not zero. The floor is actually negative.

Mr. POTTER. Right.

Mr. GRANT. That is certainly a doable sort of thing. That kind of summarizes where I come from on that subject. I have maintained that position for a good many years now. It looks like I probably will for a while.

Mr. LEE. Thank you, Dick. Anybody else want to make any comments on privatization?

Mr. WHITCHURCH. If you know, Goodyear was in that Uranium Enrichments Associates in the midseventies.

Mr. LEE. Yes and you had a letter of intent from my company.

Mr. WHITCHURCH. I didn't realize that. I wasn't involved in that. About 2 years ago, we made a study at the request of one of the ex-undersecretaries of DOE and I think Don has a copy he can make available if you wish. You know Chuck said sell to the Government and the Government becomes the broker.

That is one way to do it. That eliminates you from the uncertainties of the marketplace and controls exercised by the Government. We took a dim view of competing on the foreign markets with partially or wholly subsidized competitors.

Mr. LEE. That was based on gaseous diffusion.

Mr. WHITCHURCH. No. I am talking about 2 years ago. One thing we did, if you look at the intense capital investment and huge inventories carried, and I don't know how much of that inventory is required for strategic purposes or assurances to the Government or what, but the turnovers are very, very low. You are going to have to make one H-of-a-profit to get any kind of return on any investment.

That was one thing, one obstacle we faced.

Mr. LEE. I know two more studied; none of them in those lists. One was 10 years ago a joint venture between the TVA and Duke Power for centrifuge was undertaken a year, study, to serve those two customers. The other was 1981-82. A large group was put together of engineers and investment bankers and utilities, primarily driven by a concern about lack of action on the part of the Government with respect to nuclear waste and could we in any way take that matter into our own hands.

Using or integrating the front end and back end of the cycle, and using the enrichment business as our source of initial revenue with the idea that initially, a quasi-private entity would be formed, much like COMSAT, that would wean itself from the Government gradually, would lease gaseous diffusion plants for a limited period of time, and would undertake to build the replacement capacity.

That 1981-82 study was kept in the closet because we were driving hard with the other hand to get the Congress to enact the Waste Policy Act of 1982. After that was done our team sort of fell apart, because there were other nuclear problems demanding attention, as well as the fact that the original impetus had been—concern, action had been taken by enactment of that act.

Mr. ROWAN. I would say that was a great idea, Bill. You ought to take that out of the closet.

Mr. LEE. Our report is still—never done. But gradually privatize that end of the fuel cycle. If there were additional factors that would justify reopening the question of reprocessing to better manage the waste, that could have been included. All right. Are there any other comments, John Longenecker, that you would like to make to the panel from DOE?

Mr. LONGENECKER. You heard a lot of information in the last two days about the country's uranium enrichment program, but I stress we don't view it as DOE's enrichment program. It is the country's enrichment program. I would like to leave you with just a couple of points that I think stick out in my mind as being key to our objectives and important to our success in meeting those objectives.

We started 6 months ago by announcing the new strategy. We haven't been at this 1 year or 2 years. We announced it in February 1984. We are 6 months into the process. We recognize it will take years of good management of this country's uranium enrichment business to put us back in the strong position we desire; that is, being the world's lowest cost supplier of uranium enrichment.

Your review is timely and I know somewhat unsatisfying because you are coming in just when we have defined most of the questions, but when we don't have too many of the answers. The first point I would like to leave you with is that we recognize that if this country is to retain that competitive position it is imperative that we be more responsive to our customers.

We tried to do that by taking the first step with the U.S. contract earlier this year. We are furthering that by the work we do through further cost reductions, getting the price down to our customers, to try to serve them better in every way and be responsive to their future needs and to show them we do have a strong trend toward businesslike planning and operations within the confines of being a governmental agency.

I believe that enrichment enterprise must be operated in a businesslike way, first, then overlaying the restrictions that we have being part of a governmental agency, if we are to be successful. The past 15 years have shown that trying to operate as a Government monopoly doesn't work. I hope we have demonstrated to you the last 2 days that we hold that principle rather strongly and are doing all we can to become more businesslike.

It is particularly important if we are going to attract any interest in privatization. Dick Grant's comments, I believe, underscore that. It is important if we are to attract any investment as a first step in privatization. We are committed to managing the operation as well as we can within the limits of being a governmental agency in a businesslike manner. That comes first.

Then we overlay on that the other confines of being part of the Government. Third point I would like to leave you with is, you have heard a lot about advance in enrichment technologies, both AGC and AVLIS. We clearly have in this country the world's leadership role in developing technologies. I am convinced of that. I believe the team you have seen the last 2 days should convince you of that.

We have put in place this process with the PEB to try to measure those two and decide from a business point of view which of the two we should rely on, and in what timeframe. So we are blessed by having a great strength in technical data and information, yet unvalidated on an apples and apples comparison, but not having a firm plan for deploying it or knowing when we should. And that is the most important task we have before us in the next 9 months.

The conversion to date the new contract gives us great confidence. We believe that the total conversion to the contract will exceed our original, albeit conservative, expectations in the long-term business phase by about 50 years. But it is clear that if we are going to keep that base and compete for any new business, we are going to have to do all the things described previously.

And we can do it. I would like to express my thanks to all the people who presented all the parts of the contractor and government organizations the last 2 days. I also believe that has shown you we do have the world's best technical team, extremely key people. We have a strong commitment from all the industrial organization, some of the largest in the country.

They know how to do business, if we allow them to. And we mean to allow them to in their participation in the program. They all understand the importance of the job to be done. It has been a difficult transition over the last 6 months for them. The expertise they bring to bear is crucial, but the understanding of the problem and their role in solving it is also crucial.

I, again, want to express the appreciation of them and their companies in responding in the last 6 months to a drastic change in the uranium enrichment strategy. I realize it has not been easy. They also realize we have just begun. To date we have taken the broad objectives the Secretary gave us in February of this year and we have started to implement those into specific objectives and actions, both near and long term.

And finally, I would like to express appreciation to this panel. You feel a sense of frustration of not having had enough information—sort of a sense of frustration. The feedback we have gotten has been very beneficial. We also feel somewhat constrained that it has only been 2 days. But we appreciate the opportunity to present this information to you.

We would be glad to provide whatever additional data we could. We do encourage and communicate the expression of the Secretary. We do encourage you to give us your very candid thoughts on how we are doing, how you think we can do it better, and some of the directions you think we should take in the future. Thank you.

Mr. LEE. John, we thank you. The entire panel wants to thank you all for your participation. It has been very enlightening to us. It is an exciting subject, an important subject for our future.

We are grateful for the effort you have put into your presentations and for your attentiveness during these 2 days. Thank you for that. Now we have a question for Jeanine or Robert or Bob or other congressional staff persons here. The Congressmen are not here. You asked us to come here and do this thing.

Are there any questions we have failed to ask that you would like us to ask or any subjects that haven't been brought that you think are pertinent to this panel?

Mr. DUGAN. I had a question as to whether the Duke Power privatization report was done in conformity with accepted accounting practices? [Laughter.]

Mr. LEE. Yes; it was pretty clean there, but the legal and turf problems are not.

Ms. HULL. I think we have covered the program.

Mr. LEE. Well, again, thank you one and all. The panel will adjourn only for the time it takes to get down the hall and back and will reconvene upstairs in room 2325, in executive session.

[Whereupon, at 1:17 p.m., the committee proceeded in executive session.]

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